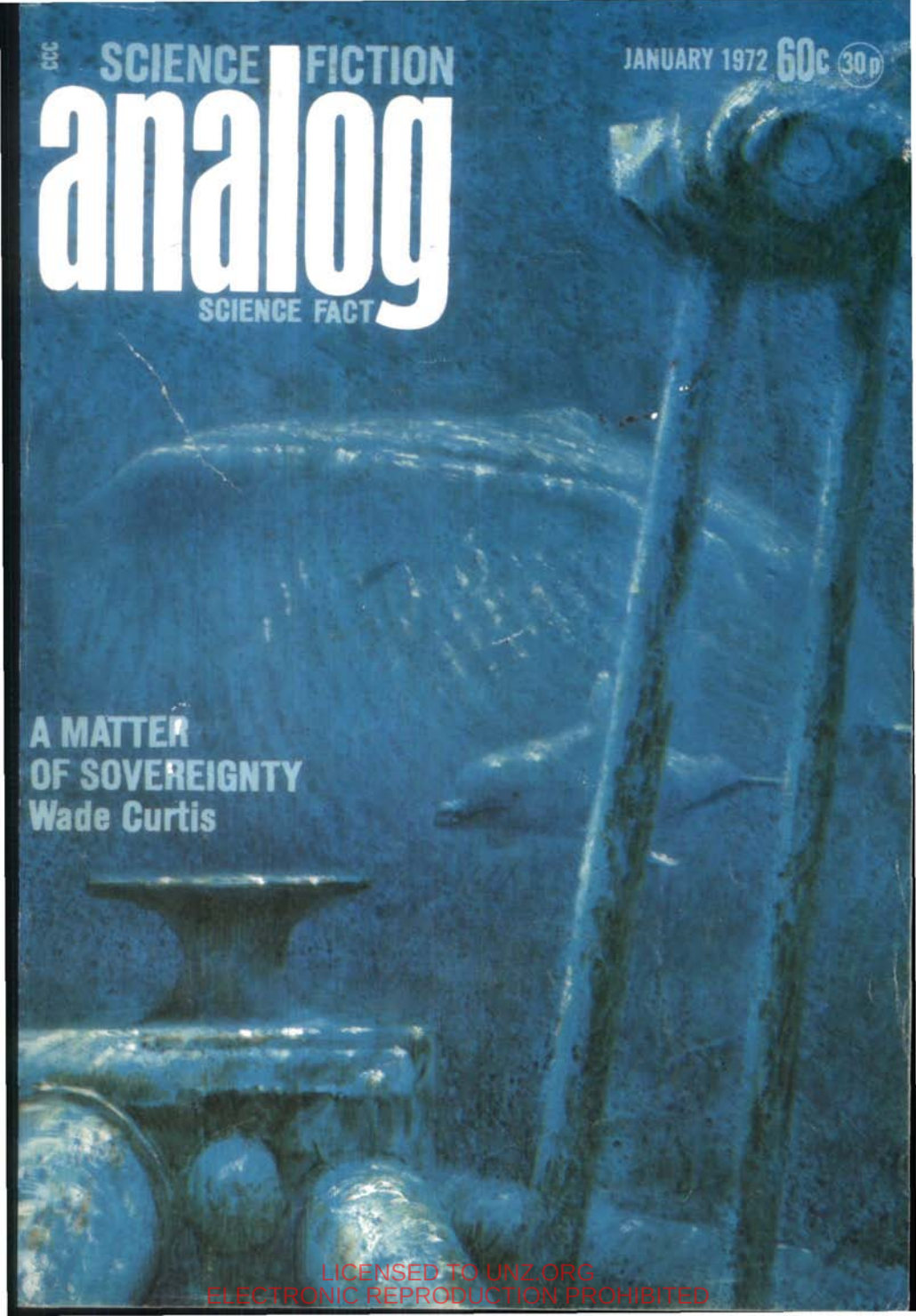

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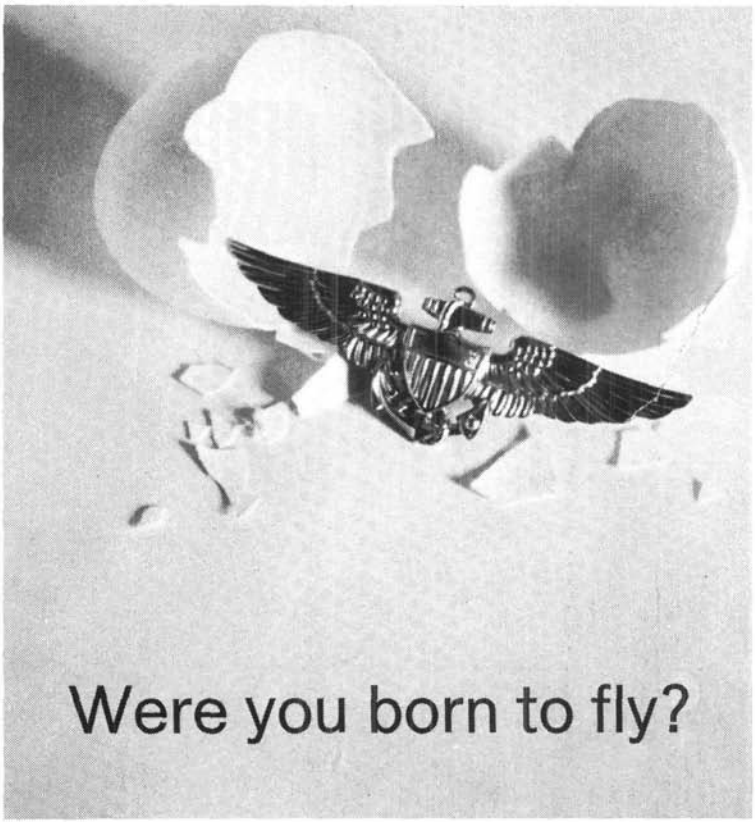

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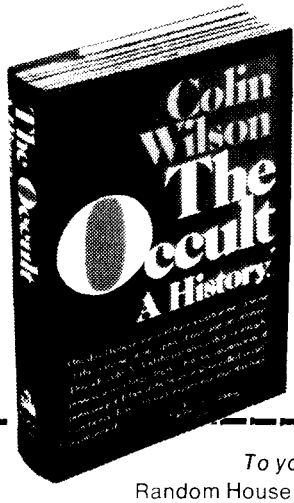

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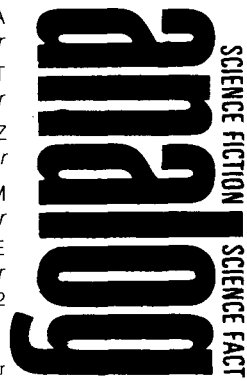
NEXT ISSUE ON SALE JANUARY 6, 1972
$6.00 per year in the U.S.A.
60 cents per copy
Cover by John Schoenherr



VOL. LXXXVIII, NO. 5 / JANUARY 1972

NOVELETTES

A MATTER OF SOVEREIGNTY, Wade Curtis 8
"RIDDLE ME THIS . . ." Christopher Anvil 108

SHORT STORIES

TRUCK DRIVER Robert Chilson 33
THE GREATEST ASSET, Isaac Asimov 44
STORMY BELLWETHER, Jack Wodhams 140

SERIAL

A SPACESHIP FOR THE KING, Jerry Pournelle 63
(Part Two of Three Parts)

SCIENCE FACT

GALACTIC GEOPOLITICS, Ben Bova 51

READER'S DEPARTMENTS

EDITORIAL, Poul Anderson 5
THE ANALYTICAL LABORATORY 139
THE REFERENCE LIBRARY, P. Schuyler Miller 165
BRASS TACKS 170

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POSTMASTER: SEND FORM 3579 to ANALOG SCIENCE FICTION/SCIENCE FACT, BOX 5205, BOULDER, COLORADO 80302.

Editorial and Advertising offices: 420 Lexington Avenue, New York, N. Y. 10017
Subscriptions: Analog Science Fiction/Science Fact, Box 5205, Boulder, Colorado 80302

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Following is a guest Editorial by
POUL ANDERSON
one of John Campbell's oldest friends and one of Analog's outstanding contributors for many years.

the asking of questions

With the passing of John Campbell, science fiction has lost its great fountainhead of creativity. We may never learn how many stories, some of them classics in our field, grew *directly out of ideas that he supplied* the authors; but we do know that the number is very large. Furthermore, writers who had no dealings with him, several of whom consider themselves post-Campbell or anti-Campbell, use a corpus of concepts which is largely of his making. The next five or ten years will show to us the dimensions of our loss.

Still, science fiction does not have to go sterile. That is the last thing John Campbell would have wished, the antithesis of all that he stood and worked for. It is up to us who love his field as he did, to continue in his tradition; but that tradition is one of ceaseless innovation, eager quest for new horizons.

In this spirit, we should go on inquiring as he did. Like him, we should especially question the "obvious truths" that everybody "knows." Above all, we should challenge our own individual certainties. The latter is by far the harder, of course. We all take beliefs for granted which we don't even realize *are* beliefs.

In this period of mourning for our friend, we might begin with the subject of death. We'll go on to life, which he enjoyed as hugely as every healthy human being does. But first consider the corollary, that we have a fundamental abhorrence of death. We either believe in survival beyond the grave, or wish we did. We may be prepared to die bravely, but unless we are in an abnormal state, we will never die willingly—and this is *true of all mankind.*

Is it? Really? Are you sure? Does instinct make you desire immortality, or just cultural conditioning?

The fact is, most primitive mythologies have held that, if the dead continue in any fashion, it is a dim, spooky, altogether unpleasant kind of existence. Perhaps that is why the classical Greeks, Romans, and others eventually gave up that belief and embraced the concept of simple, kindly oblivion. But the Jews had long been at this stage. Except, debatably, for a few hints in the very latest prophets, the Old Testament

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makes no mention of any kind of possible afterlife.

Likewise, while Hinduism and Buddhism have some ideas about metempsychosis, these do not imply that any part of the individual personality will go on in a new body. The Chinese formerly paid respects to the memories of their ancestors; they never actually worshiped them. Their own Twentieth-Century descendants assuredly don't. Nor are you likely to find many people in modern Russia who believe they will survive their own flesh, or seem especially bothered by the prospect of departing from existence after a full life. I wonder how many are left in the West.

Could it then be that Christianity, under the influence of mystery cults confined to a rather narrow part of the ancient world, and Christianity's rebellious child Islam, are the freaks? Do we crave to live indefinitely because instinct shapes our psyches, or is this merely a wish that, for centuries, Western man has been told he ought to have?

I don't know. I doubt if anyone does. I am only pointing out that we have made an assumption about human nature which may or may not be true but which rests on no good evidence.

John Campbell himself, in a letter to me, raised a similar question—I can imagine his big friendly-impish grin while he did—about sex. We must once have had some innate tendency in that direction, or the species would have died out long ago. But how strong is it today? Celibacy is not uncommon in history. Do you, modern man, desire women because that's how your genes work, or do you do so because you have been trained to it?

After all, our breed has been around for a long time. The oldest hominid jaw discovered thus far has been dated about five and a half million years back, and its possessor must have had ancestors not too unlike himself. Granted, these were not yet Homo sapiens; we don't know if they truly had language. But they were high-grade mammals, and such animals always do a good deal of rearing of their young.

Suppose they had inborn drives, as for instance toward sex. But suppose also that, more and more as the species evolved, they could be educated to behave in ways that seemed desirable. This would include reproduction; primitive communities need a high birth rate to maintain themselves. Well, nature gets rid of unused capabilities. Might the hypothetical genes which made protoman innately sexual not be lost when they were no longer needed?

If two babies, a boy and a girl, were isolated from the rest of humanity, raised by robots which never gave them any particular information about sex or examples of sexual love—how would they behave when they matured?

Again, I don't know. Do you? Are you certain?

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This brings up still another assumption, about biological degeneracy. As remarked above, when a species no longer uses one of its organs, then natural selection no longer weeds out unfavorable mutations in it. They accumulate over many generations; the part becomes more and more atrophied and deformed; at last it disappears. The eyes of fish which have taken to living in lightless caves are one famous example. Man's vermiform appendix is another. A less well-known case is man's inability, rare among animals, to synthesize Vitamin C. Apparently our distant ancestors lost it, but in a vegetable-rich environment continued to get along well enough. That is, there was no natural selection against these mutants. Hence they reproduced their kind. As one ultimate result, sailors at sea for long periods used to get scurvy. If Linus Pauling is right, another result is our tendency to catch cold.

Burst appendixes, scurvy, and respiratory disease have killed quite a few people. Nowadays they can be saved by surgeons, proper diet, antibiotics, and the like. By keeping the most susceptible alive to breed, medicine is hastening the decay of the genes concerned.

We have all read stories about a future in which man has become a big-headed dwarf, hopelessly dependent on elaborate machinery. Is this not a terrible prospect? Is it not a potent argument for eugenics?

Conceivably it is, but conceivably it isn't. Remember, biological fitness is relative. Parasites become degenerate—that's one way of phrasing it. Another, probably more valid way is to observe that they simplify their bodies and thus become more efficient parasites. Likewise, is man degenerate because his jaws have become small and weak compared to an ape's? Or has he merely "discovered" that, on the whole, he can do better with edged tools and weapons than with huge maxillary muscles?

Evolution may actually require such losses. Though the data storage capacity of the chromosomes is enormous, it cannot be infinite. A DNA molecule engaged in controlling the production of, say, fur, is to that extent not controlling the production of, say, nervous tissue. Are these genes which once gave us good appendixes now giving us keen eyesight? And if so, may we have to sacrifice the eyesight in turn, resign ourselves to artificial aids like spectacles, in order to develop better brains?

Is the big-domed midget among his machines, a million years from now, really so ghastly to contemplate? Think about it.

To be sure, he may never come into being anyhow. Humans, supported in luxury by their robots, might go in more for the body beautiful than for intellection. A peaceful and affluent society might come to admire athletes above scientists. No

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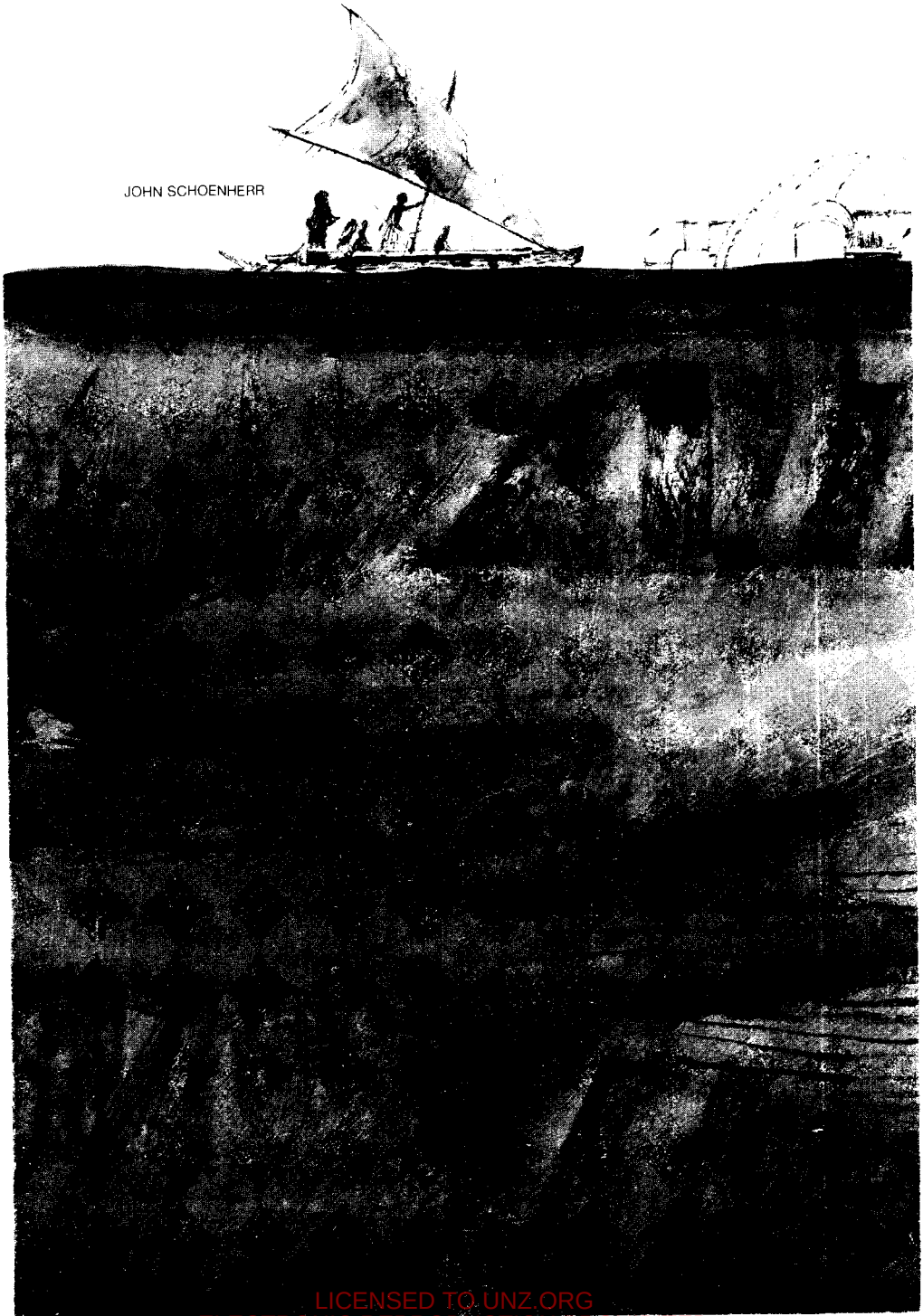

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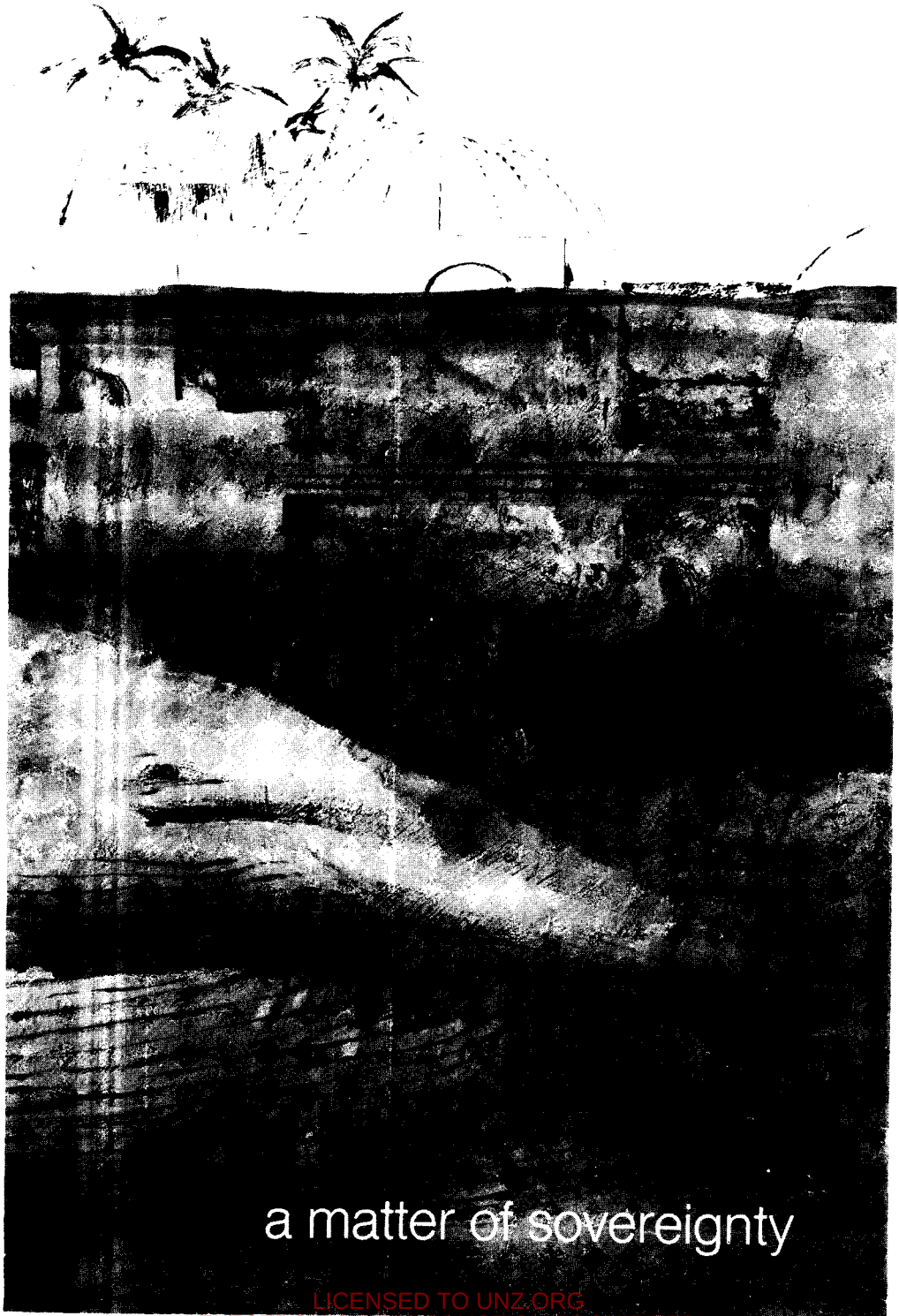

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Power is a strange thing: sometimes those who have it can't legally use it. But that never stops really determined men . . .

WADE CURTIS

"We're almost there, Mr. Adams."

The dream faded, and Bill Adams stirred lazily, looked up at blue eyes and heart-shaped face framed in long blond hair. The lovely soprano voice had a trace of English accent, a conservative miniskirt showed tanned legs. It was one of the better ways to wake up.

He glanced around the lush interior of the airplane, heard the thrum of propellers. The Pacific flashed deep blue far beneath as it had when he dozed off, but now it was dotted with tiny white rings, surf crashing endlessly on coral.

"I said, we're almost there, sir," she repeated. "I've got coffee here for you."

"Thanks, Courtney. Sit down and have a cup with me. You can tell me what I'm looking at."

"All right." She balanced the tray clumsily with one hand, almost tipping it, as she reached to fold down the table from the cabin wall. Adams hurriedly came to full wakefulness and they managed to get the coffee down without incident. The girl sat next to him, smiling uncertainly. She wasn't sure who Bill Adams was. On the Nuclear General Company organization chart he was in the headquarters box with the Chairman of the Board, but his title said merely "Assistant to the Chairman." Since she was "Assistant to the Director" of Ta'avu Station she knew the title didn't have to mean very much. But Adams was in charge of this airplane, and anyone who could com-

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mand *Cerebrus* must have more influence than the job title indicated. He had to be one of Mr. Lewis's special assistants, who were said to have no emotions and computers for hearts, but his easy smile made that hard to believe.

Adams sipped coffee and looked out the thick rectangular window. There was more land ahead now, a series of coral atolls stretched out like jumbled beads on the blue water below him, each ringed with white, then lighter blue fading quickly into the deeper tones of the Pacific. There was no way to estimate the size of the islands, those might be tiny coral reefs or the tops of large mountains. One thing was certain, there wasn't much land you could live on.

"That's good coffee, Courtney. Thanks."

"I should be thanking you. It would have been three weeks before I could get home." She showed no interest in the islands after giving them a brief glance, instead looked around the airplane. They were the only passengers in the big lounge although it had seats for a dozen and behind that were two offices, a small laboratory, and several staterooms. Aft of those was an enormous cargo space. *Cerebrus* was big, one of the biggest airplanes in the world, and she shared its luxury with one man. It was quite an experience. Adams was peering forward, trying to get a better look, and she remembered why he had asked her to sit with him.

"The first group is undeveloped so far," she said. "You can just see Ta'avu Station beyond it, you'd best wait until we're closer before I put on my bus conductor hat." Adams grinned, pushed back sandy hair with a careless gesture. She noted again that he wore no rings. "Anyway," she said, "I've wanted to ask about this plane and I haven't had a chance. How could even Mr. Lewis afford it?"

"He couldn't," Bill answered. "Some African government went broke having it built. Last big flying boat ever constructed. Nuclear General bought it for salvage, installed the atomic power ourselves."

"But nobody builds propeller planes anymore," Courtney protested. "I'd have thought you'd put in jets."

Adams shrugged. He was no engineer. "Something about efficiency. *Cerebrus* is designed to stay up for weeks at a time, look for ice floes in the fog and get men aboard to put in our claim. Competition for good Antarctic ice is stiff, but *Cerebrus* gives us a big edge. Not to mention the whale-herding project which we could never have done without the plane. Ferrying pretty young managerial assistants is just a sideline." He drained the coffee. "Is that the Station?"

"Yes." She leaned across him to see better, felt him close to her. He was handsome enough, unmarried, in his thirties by his looks but maybe a bit more. She liked older

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men. And he had gray eyes, hard to tell what he thought because he always looked as if something amused him. Her last romance had gone badly, there was no one at the Station . . . there was never anyone at the Station. She wondered how long Adams would be there, he hadn't told her a thing about why he was flying thousands of miles to the Tonga Islands, and Mr. MacRae would be worried.

"The big atoll in the center of that group of three," she said. "The lagoon is about fifteen miles across, and the Station is on the island at the fringe, the one shaped like a shark. The reactors are just about at the jaw."

"Yeah." Now that she'd given him some idea of the scale the rest of the picture was clear. Ta'avu consisted of seven atolls, but only three were in use at the moment. Nuclear General bought the whole chain from the King of Tonga, paying off with electric power, fresh water, fish, fertilizer, and expert advice on how to support too many Tongans on too few islands. The land area of Ta'avu was insignificant, but it wasn't land they needed.

Now he could make out the big microwave dishes which beamed power from the Station to the inhabited parts of the Tonga Islands. A wasteful way to transmit power, but there was plenty to spare at the Station. The plane circled lower and Adams could see dams and locks, enormous sea walls closing off the lagoons from the oceans. He winced, remembering how much they had cost, and then there were the smaller dams and net booms dividing the lagoon into pens.

A chime sounded and Adams picked up the phone. Michael King, his new assistant, said "We're almost there, sir. Shall we take her in?"

"No. Have the pilots circle the Station. I want a better picture before I land."

"Yes, sir. Want me back there?"

"No, I think Miss Graves can tell me what I need to know. Unless you'd care to join us?"

King laughed nervously, betraying his youth. "Thanks, but I'd rather not . . . uh, the pilots are giving me a pretty good briefing, sir."

"Fine." Adams hung up the phone, chuckled softly. Michael hadn't been with him long, but there was no question about it, Mrs. Leslie King seemed to have a great deal of influence over her husband. Fancy being afraid to be around Courtney . . . of course she was pretty and Leslie would be joining Mike if Adams decided to leave the boy at the Station, maybe Michael was right to stay away from temptation. The plane dropped lower, down to five hundred feet. Bill Adams turned to Courtney.

"Where are the whales?"

"In the big lagoon—there, look carefully, you can usually see them. Yes!" She pointed excitedly. "Over

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there, on the other side from the reactors."

Adams looked for a moment, then gasped. There were three dark shapes visible under the water, and they were *big*. One seemed to grow, larger, larger, impossibly huge, then broke the surface and rolled lazily, great flukes splashing. A hundred feet long, the largest thing that ever lived on Earth.

"That's Susie." Courtney said happily. "She's almost tame, you can get close to her in a boat."

"My God that's a big animal!" Bill said. "What are the small things around her? Baby whales?"

Courtney laughed. "Those are *dolphins*, Mr. Adams. We don't have any baby blue whales, nobody does. We hope Susie's pregnant, but how can you tell? The dolphins patrol the lagoon for us . . . you know how we used them to get Susie and her friends here in the first place?"

Adams shook his head. "Not really. I was busy on something else." He made a wry face. "This whale business is strange. Only thing the Company ever did that doesn't at least *threaten* a profit. Mr. Lewis insists on it, but you can't imagine how much it has cost."

"Oh." She looked at him sternly, let a note of disapproval into her voice. "It was worth it, Mr. Adams. Look at those whales! How could you let something so magnificent be exterminated? I guess it was costly, though," she added hastily. Shouldn't get him angry with me. . . . "Never gave it a thought, but—well, training the dolphins to herd whales took a long time. Then finding the whales—there aren't more than a dozen left in the whole world. And even with the dolphins it took a long time to drive four whales to the Station. They kept getting away and the dolphins had to go find them again."

"I know something about how long it took," Adams observed dryly. "While *Cerebrus* was on that project we lost two three hundred billion gallon icebergs to Southern California Edison. That left *Poseidon* and *Aquarius* out in the Antarctic with nothing to do for months, too expensive to bring the tugs home and send them out again." He grinned suddenly. "Worked out all right. Couple of months later we found a nine hundred billion gallon berg, a real monster, and got it under tow."

And, he thought, it's still under tow, cruising up the Humboldt current. Worth about a hundred million dollars if they could get it to Los Angeles, but with Ecuador asserting claims to waters out two hundred miles from their coast the passage fees might eat up half of that. And now *Persephone* was held by the Fijiians with all that plutonium, and Nuclear General was in real trouble. Most of the Company's assets were tied up in those two projects, and Mr. Lewis was stretched thin with risky investments. The big bergs made a lot of profit, but exploration and towing weren't cheap, com-

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petition was stiff, and the taxes kept going up all the time . . . if they couldn't get that plutonium back—

"The other lagoons have smaller fish," Courtney said, breaking in on his reverie. She wondered why he'd lost his grin, but it came back when she pointed and said "Rainbow trout in that one."

"You're putting me on."

"No, really, they adapt to salt water very easily . . . in fact they do it naturally, haven't you ever fished for steelhead? And hatching them is easy, that's been done for decades."

"Yeah, I guess it figures," Bill answered absently. Come to think of it he had known that, used to fish for steelhead when he was younger. Hard to think of anything but the plan, it had to work. It had sounded good back in Santa Barbara, but neither he nor Mr. Lewis had ever met the Tongans and it all depended on them—

"You can see the different color waters," she continued. "We pump cold water from 6,000 feet down. It's rich in phosphates and nitrates, so the plankton and krill grow fast . . . Dr. Martinez is experimenting to see what works best. But if we can feed Susie, think how many fish we can grow in the other lagoons!"

Bill nodded. He'd seen the figures. There was a good profit in protein but production was low at Tonga Station, and there'd be no profit at all if the farms had to pay their own way. He tried to explain that to the girl, but she wasn't much interested. Blast it, he thought, she should know such elementary things about the Company. Without funds and profits you couldn't do anything—

"Profits. I see." Her voice was acid. "I guess you have to worry about that, Mr. Adams, but out here at the Station we're proud of what we're doing. We can feed a million people some day, more even, and prevent kwashiorkor . . . do you know how much misery is due to simple protein deficiency?"

"No. But I know we couldn't have built the plants if that were all we were doing out here, Courtney. Breeding plutonium on a grand scale makes power, and as far as the Station's concerned that power is free. But plutonium, not protein, is the reason for the Station."

"Why out here, then? You've got breeder reactors in the States, Dr. Martinez is Director of one."

Adams nodded wearily. "We didn't put new breeders in the States because we can't find locations for them. Everywhere we turn there's protest. They even complain about our sea farms because we introduce new species. As if Kansas wheat were native . . . Anyway, Tonga's got cold water for the reactors and no regulations about our plutonium sales. In the States the government makes us sell over half the product at their own prices." Taxes were nonexistent at the Station, too, Adams thought. Even though there was no market for the electric power the

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breeders could produce, it was still worth coming out here. And the protein sales would eventually pull their own weight, even pay back some of the investment Ta'avu represented. It had been a good gamble, but too big, too big, now the crunch was coming. A shortage of cash, and the creditors coming around like wolves.

A chime sounded and above the entrance to the flight control deck the "NO SMOKING. FASTEN SEAT BELTS" signs came on. The chime sounded again and Adams lifted the telephone.

"We're bringing her down now, sir. Some nasty weather expected later, the pilots want to get *Cerebrus* inside the lagoon while it's calm. If that's all right with you, sir."

"Fine. Take her in," Adams told him.

The big plane banked sharply, leveled and skimmed lower and lower across the water, touched into the swells outside the lagoon. They bucked four-foot whitecapped waves as the plane taxied to the atoll. Big lock gates opened ahead of them and the plane moved inside cautiously. Adams watched a floating object appear around the hull; it resembled the plastic baths yachts were kept in back in the States, or the floating tanks used to catch fresh water from icebergs. He turned to Courtney with a puzzled expression.

"Biological trap," she said. "They can purge the whole lock area if they have to, but it's easier this way. They'll sluice out the bath with cold water from the deeps and slide the plane off into the lagoon."

He nodded, was about to say something when the pilot came out with Michael King. "That's it, sir," Mike said. "Boat's alongside to take you to the Station."

"Fine," Adams said, but he didn't feel fine. His senses were dulled by the time differential from Santa Barbara, the mild chop taxiing in had upset his stomach, and ahead of him were problems enough to wreck the Company. The turmoil of thoughts contrasted sharply with the peaceful scene of the lagoon and the girl beside him, and he chuckled slightly, but when Courtney smiled quickly he didn't see her.

She turned away hurt, wondering what he was thinking about. Profits, she thought contemptuously. How could any man look at that out there, blue water and sparkling sun, the dolphins dancing around the open companionway hoping for attention—they got enough to eat—and the big Tonga boatmen grinning from their long narrow outrigger; how could a *man* look at all that and think about money? It never failed. The unmarried ones had something wrong with them, and of course, that would be true; if they didn't, why weren't they married?

The outrigger flashed across the lagoon, skimming almost silently in the strong trade wind and calm water. Danual and Toruga, the boat-

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men, handled her almost effortlessly. They weren't really boatmen, of course. They'd call themselves fishermen, or just sea people; back in the States they'd be technicians, and damned skilled ones at that. They and fifty like them tended the sea farms under the direction of Ta'avu's ecologist on loan, Dr. Arturo Martinez who'd be anxious no doubt to get back to his home in San Juan Capistrano.

There were motorboats at the Station, but the silently skimming outrigger seemed more natural and was certainly almost as fast. Besides, it disturbed fewer sea creatures. After a while Adams was able to lean back and enjoy himself, listening to Courtney chatter with the Tongans in the musical Polynesian language.

Around the edge of the lagoon was a series of pens and baffles and large fiberglass tank complexes, each served with a network of pipes for delivering both cold nutrient water from over a mile down outside the atoll and heated water from the reactors. Courtney tried to tell Bill Adams what each pen was, but there were too many. After a while Toruga took over at the tiller and Danual came forward to join Adams. Like all Tongans he spoke English. It was the Kingdom's second language, a principal factor in locating the Station at Ta'avu.

"We have all kinds of fish, sir," the boatman said. "Some we catch around the reefs, some Dr. Martinez sends for—from all over the world."

"Which ones grow best?" Adams asked.

The Tongan laughed heartily. "We won't know that for years. Look at what we can do, temperatures, plankton mixes, dry fertilizers—one thing we try is different cleaners."

"Cleaners?"

"Yes, sir. What lubbers call trash fish. Little ones that clean up parasites. And shrimps. Big fish need 'em to live. There's a lot even the sea people don't know—"

Adams looked at him sharply, nodded. No wonder Dr. Martinez was pleased with his technicians, they'd know more about the reefs and the water than anyone else, and with their excellent basic school system it shouldn't take long to train them in systematic observation.

"Another thing, maybe you can see down there." Danual said. He pointed down into the clear water. "Different shapes for reefs. We make them out of fiberglass in the shops. Makes a lot of difference what kind of fish live in them."

They passed a series of rafts, each supporting long lines dangling into the lagoon. Danual, pointing to them, said: "Oyster farms. That's the hatchery, when the rafts are full we move 'em. Take some outside the lagoon, keep some here."

"What do you do about predators?" Bill asked.

"Look," Courtney told him. One of the dolphins swam near the boat, a starfish clutched in its bill. "Our technicians catch them, but the dol-

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phins do a better job," she said. "It's amazing what you can train them to do. Some want to please you."

"Hard to operate here without dolphins," Danual agreed. "That's something we learned from you. But there's a lot the sea people know that didn't come from books."

"I'm sure," Adams agreed. "You like working here?"

"Who wouldn't?" Danual asked. "Why would anybody do something else?"

"We're just learning about sea farming. I mean really learning," Courtney said. "When I think of the nonsense I was taught in schools—and there are so many variables. As Danual said, there're temperatures, reef shapes, species mixtures—and some of the parasites are necessary, some of them have to be eliminated. All we can do is try things, there aren't any good theories."

"Yeah." What was it Helmholtz said. Adams thought. The most practical thing in the world is a good theory . . . well, that was all very well, but this wasn't just a research station. It was supposed to be a producing farm, and they'd better start getting something to sell out of those lagoons if they expected any more internal research and development funding.

It was nearly dark when they reached the Station—there is no twilight in the tropics. The sun fell into the sea and was gone. The lagoon became dark and mysterious, then suddenly flashed with whites and blues and greens, phosphorescent streaks all about them, an endlessly changing light show. Two enormous shapes glided past the boat, turned and charged for it again. Adams eyed them nervously.

Courtney grinned, her teeth barely visible in the pale moonlight. "I wouldn't worry about them, those are the dolphins again," she said. Then she giggled softly. "They like to swim with the boats, and the phosphorescence makes them look bigger than they are. I pity any sharks that do manage to get inside the lagoon."

"Some do?"

"Yes. We can't keep a perfectly closed system in the open lagoons the way we can in the pens."

"You know a lot about the operations here," Adams said quietly.

She smiled. "I've been here four years," She sighed. "I like it here but it's time to move on. I've asked for a transfer to Company headquarters."

"Why?"

"Well, I'm not really a biologist, and there's not a lot of management work here at the Station. Dr. MacRae leaves most of that up to Santa Barbara."

I've noticed, Adams thought. He looked at the girl, wondering if she could learn the important points about Nuclear General operations. She did all right with the technical stuff, and Mike King would have to stay here at the Station. She might be good company.

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They glided expertly to the landing. The reactor domes were invisible a thousand yards away, and the Station was a low series of concrete rectangles along the reef, much of it extending down into the lagoon itself. There was almost no land, and everything had to be attached to the reefs, anchored deep with aluminum pilings to protect it from tsunamis and typhoons. A natural fortress, Adams thought.

Living quarters were made of fiberglass, constructed like the thatch and frond houses of Polynesia but using artificial fibers. They could be taken below into the concrete blockhouses if a real storm threatened, and were much more pleasant to live in.

Adams took his supper alone, served by Mike King in his rooms. He'd met no one, not even Art Martinez, and he wanted it that way. When he put down his fork he realized he didn't even know what he'd eaten, and it was probably a special meal. Well, there'd be time enough for the special amenities later. Now he was as ready as he'd ever be.

"Who's all's there?" he asked.

Mike King blushed slightly. Staff men assigned to Bill Adams never lasted long—when Adams wanted to know something, you'd better be ready with an answer, or know how to find it. And you could never tell what he'd want to know because Adams himself didn't know what would be significant. Mike had spent as much time as he could talking to anyone he could find, but as sure as anything it wouldn't be enough. Working with Adams was good experience, but Mike would be glad when the troubleshooter moved on.

"Dr. MacRae, Dr. Martinez, that I know of." Mike said. "And Courtney Graves. Dr. MacRae said if you were going to have an assistant at the conference then by the white Christ—that's what he said, sir—he'd have one there, too."

Adams exploded in laughter. "And what about the Tonganese?"

"Prince Toki Ukamea, the Prime Minister, is at the Station, sir. With a couple of members of the Privy Council. But he's out looking at the reactors so you can have a word with the others alone as you wanted."

"Good." Adam's tone was so noncommittal that Mike King looked at his superior closely, but he couldn't tell what the man was thinking. The hidden amusement was gone from the gray eyes, and King didn't envy the people who'd got Mr. Adams so upset.

The conference room was underwater, concrete walls paneled in rich woods framed with sea shells, an enormous rainbow trout stuffed and mounted on one wall. Another wall was completely glassed, showing the dark waters of the lagoon outside. Several large fish and one of the inevitable dolphins swam directly just outside the conference room.

Dr. David MacRae was a tall elderly man, who spoke with a thick

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broad Scots accent mixed with something unrecognizable, and he sucked endlessly on a completely disreputable pipe. Adams shook hands with the director, let his mental filing system bring up the important facts as he did: MacRae, licensed reactor operator, master of arts in marine biology from Wellington University, New Zealand, honorary Ph.D., Edinburgh. Reactor physics courses at Nuclear General's own schools. With the Company over fifteen years, mostly in overseas posts. Apprentice power operator somewhere in his native highlands, that was a long time ago.

Bill turned with pleasure to Arturo Martinez, shook his hand warmly. "Glad to see you, Art. How're Dianne and the kids?"

"Everyone is fine at home, Bill," Martinez said. "I was supposed to go back last week, but now—I don't know if I can help, but I thought I would stay until this is settled."

Adams nodded soberly, took a seat at the thick wooden conference table. "All right, Dr. MacRae, how did it happen?"

MacRae lit his pipe slowly, letting the flame play over the entire bowl and taking several experimental puffs before he answered. "We had a storm in the channel," he said carefully. "*Persephone* was in shallow waters with large waves breaking around her. There were reports of a bigger storm comin' and Captain Anderson thinking of the cargo decided to take her into harbor to be safe . . . aye, and I agreed when he called the Station. I had nae thought o' trouble."

"And the Fijiians boarded her and took over," Adams finished. "Any change in her status?"

MacRae shook his head. Like all his movements it was slow, almost majestic, as if he controlled time and could slow it to suit himself. "They say 'twould nae be safe to allow the ship to leave harbor wi' that cargo, and their 'experts' will examine her for damage from the storm. 'Tis blackmail simple, Mr. Adams. They've nae experts to begin wi' and there's nae the matter wi' *Persephone*. But you would nae let me report the ship stolen—"

"Time enough for that," Adams said grimly. "For the moment it's better we don't have an open break. They don't actually claim the ship or cargo then?"

"Nae." MacRae shook his great head. "But 'tis only a matter o' time in my thought. Then they will 'discover' storm damage that only they can repair and confiscate the cargo for the safety o' the human race."

Adams nodded. "The Earth safety boys are likely to support them. Are you sure the cargo's still aboard?"

"Aye. There's nae man in Fiji fool enough to go in there, they'll need friends from the mainland for that. The containers are sealed, encased in glassite. In case o' sinking, you know. So the plutonium will nae foul the oceans if the ship is lost."

"Yeah." Adams nodded thought-

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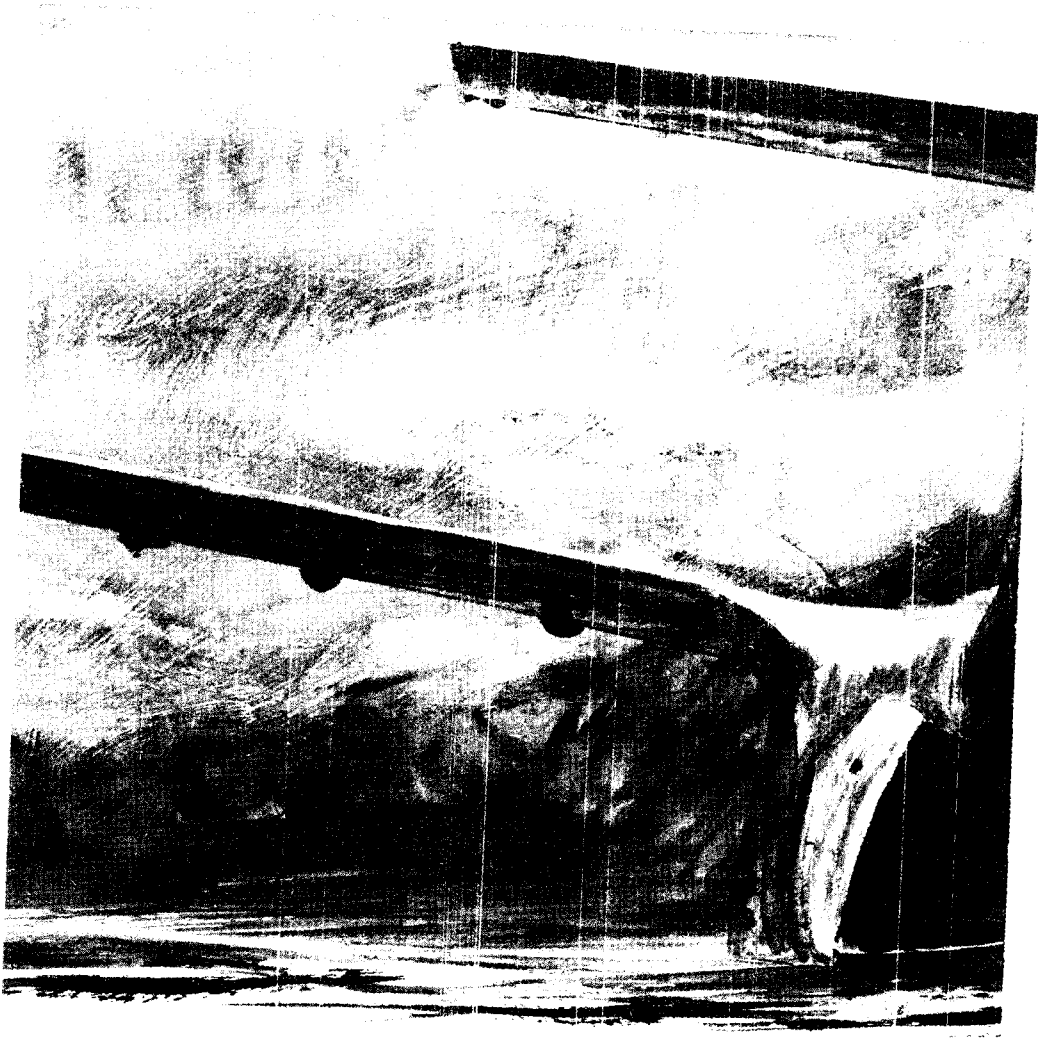

fully. "Now tell me about the troubles the Tongans are having with Fiji."

MacRae nodded slowly again. "You know about the politics?" he asked. When Adams didn't answer he continued "Both Tonga and Fiji have been under British protection, but now the Royal Navy's gone from the Pacific and both countries are independent."

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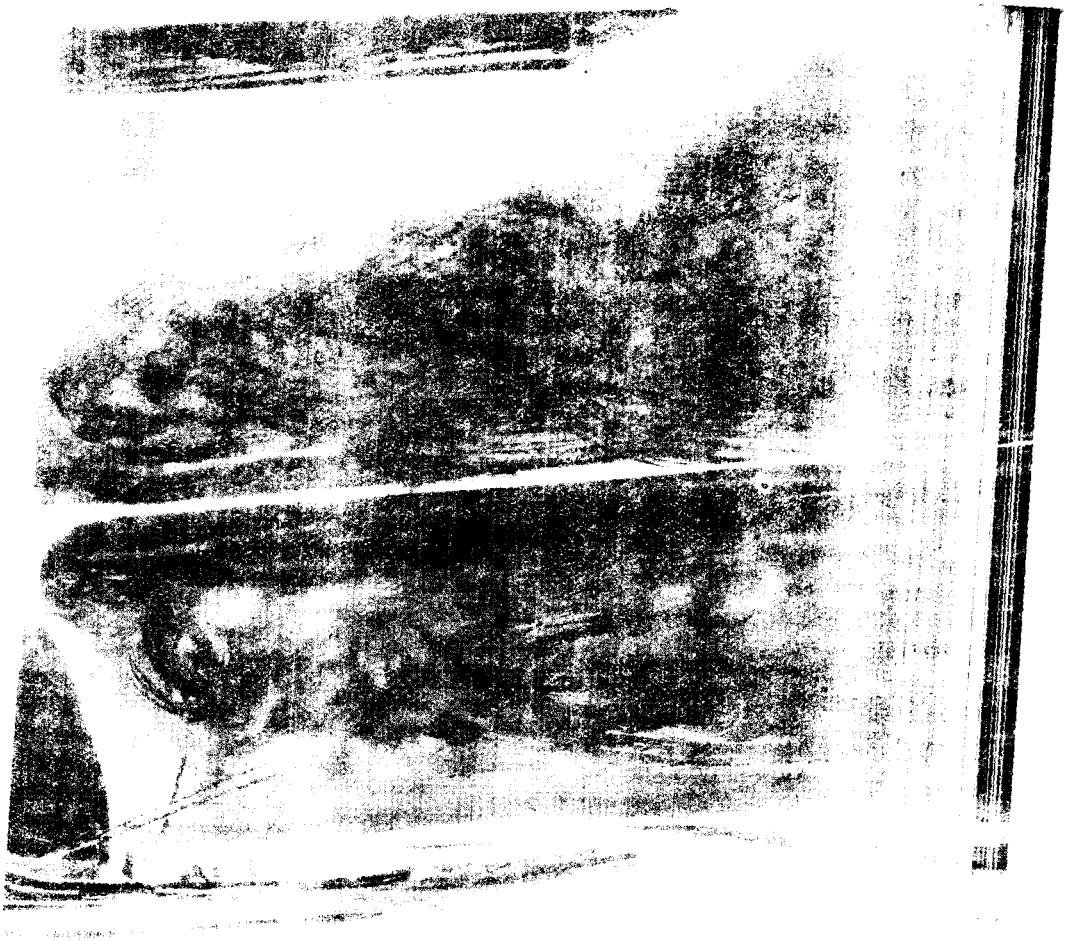

Tonga always

surprised, noticed

Mr. [illegible] replying "Aye. But

enraged Tongan

Now that's gone, too. And

since the British left the Fijians have claimed sovereignty over waters almost to the Tonga Islands, have seized more than a dozen Tongan fishing boats. Naow they've had *Persephone* for three days."

1. Militant Sovereignty

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"Did the seizures of Tongan boats come before they took *Persephone?*"

"Aye. I see what you're thinking, Mon, but how would we know they'd take a ship flying the U.S. flag?" MacRae demanded. "That they'd take boats from the Tongans does nae imply they'd defy the U.S. flag! Mon, you sit here talking to us when you've only to report piracy and have the U.S. Navy get our ship back!"

Adams laughed bitterly. "Do you think we haven't tried? The State Department says the matter is very delicate . . . and the Fijiians have good advice from somewhere. They've unofficially let it be known they'll fight before they give up our ship. The U.S. won't bully a small power to support Nuclear General Company."

"I see," MacRae said. "Then 'tis more serious than we thought."

"But I don't understand," Courtney protested. "Nuclear General has a stranglehold on dozens of little countries. You've got a reactor in Fiji, that's where they get their power—and the influence the Company must have, food supplies, everything, surely you can pressure them to give us our ship?"

Adams grinned, but there was no humor in it. "You've misunderstood a couple of things. The mainstay of our power is plutonium, and at the moment we haven't much to bargain with. The Fijiians do. They've got a couple of hundred million dollars worth of it aboard *Persephone.* With what they can trade that for, they can laugh at any threats we make."

MacRae puffed at his pipe, relighted it. "Then we're in trouble. But we've the Station, we can breed more."

Adams said nothing. Mr. Lewis's creditors would be on him in seconds if they heard about the loss of *Persephone.* If the iceberg could be got to Los Angeles before the news broke, there might be enough cash to bail the company out, but the Fijiians wouldn't sit on it that long, and the rumors were already out. "Tell me about Tonga, Dr. MacRae. How much of your report about our relationship with the government can I believe?"

"All of it," MacRae snapped. He brooded heavily, then nodded. "Aye. It may sound too good to be true, but it is so.We've nae problems at all wi' the King and government. They're happy to have us here, for their people hae no talent for technology. Or, if they do, they've no interest."

"They work well with the Project," Martinez added. He nodded confirmation to MacRae's statements. "You've heard me say they're natural ecologists, they'll have no trouble operating when I'm gone. A real talent for sea farming. But David's right, they have no interest in the reactors at all."

"O.K. That's the King. What about the people?"

"Same thing," MacRae said. "They respect the King. He gives them good government, and don't

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forget they're almost the only islands which were never colonized by Europeans, held their independence right along under the same royal family. There's nae opposition to speak of. The King gives every boy a bit of land when he turns seventeen, or something worth the same since there's little land to be had. And they allow no foreigners to own, or lease, land here. We're an exception, but the land here's worthless without our improvements. With our help they've reclaimed other atolls closer to the main islands, and we've shown them how to build sea farms for their own . . . no, Mr. Adams, strangely enough this is as close to Paradise on Earth as you'll ever find."

Adams sat quietly for a moment, nodding to himself. "O.K. So the basic situation makes it possible for us to survive here. Now tell me about the Station itself."

"What do you want to know?" Martinez asked. "The reactors are fine. And we've got the world's largest sea farms, we're only getting started. *Por Dios*, Bill, it's an ecologist's dream."

"And an accountant's nightmare," Adams answered. "The reactors pay their way in plutonium and the power's free—nearly so, the turbines were expensive but we had to generate power to pay the Tongans for their atolls. But the real construction, reefs, pumps, pipelines, Art—it's been two years and there's damn little return on investment. The equivalent amount invested in nuclear-powered food-processing ships and trawlers would be earning us money right now!"

"Mon, Mon, do you nae understand?" MacRae protested. His open palm struck the table with a flat crack. "Trawlers! No matter how modern you make those beasties they're ten thousand years out of date! Civilized men are nae hunters, laddie. We cultivate, we grow what we need, and how can we do that in open water? The investment here will pay for itself, never you fear, and I'm willin' to gamble you'll be putting in more farms with what we learn."

"He's right," Martinez said. "Our open farms in the States are profitable, you'll agree?" Adams nodded, and Martinez continued "But we have poachers since we can't get title to the sea beds. Out here we own the waters, and nothing at home has the potential of these reefs, Bill. We can grow anything in enormous quantities. The Project's already starting to produce, give us a year. I've got five square miles under intensive cultivation. We'll clear over a thousand salable tons to the square mile. At ten cents a pound—and you know we'll get more than that, Bill—we'll take in a million dollars."

"About two percent of the cost of those dams," Adams reminded him. Before Martinez could protest Bill interrupted. "Yeah, I know. You've got a lot more square miles you'll

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bring in next year. I've seen the projections. But the Company's got cash problems, and this place had better plan on paying its own way." He pushed back his chair, turned to the windows of the lagoon.

"Don't . . . don't you ever do anything just because it's worth doing?" Courtney asked. Her voice was not quite under control, as if she were holding back anger.

Adams shrugged. "When you're talking about as much money as this Project costs, you get into the altruism game precisely once. O.K., if you'll ask His Highness to come in I'd like to meet him. And I give all of you warning, be careful what you say when he's here."

"Would you rather we left?" Courtney asked.

"No. I may need all of my advisers. But keep your little round mouth closed unless I ask for something, will you? All right, Mike."

His Highness Toki Ukamea, Prime Minister and Crown Prince, was a giant for a Tongan. He stood six feet two, with broad shoulders and hips. Adams noted the massive hands and legs, and that the full middle had no sag at all. The two councillors were normal-sized Tongans, short and rather slender but well-muscled, and both wore open, flowered shirts. His Highness was wearing a dark suit and regimental striped tie which Adams noted thoughtfully. Cambridge or Oxford, couldn't remember which for which college.

There were few formalities. After the introductions they sat at the big conference table and Adams nodded to Michael King, who began by telling the Prince about *Persephone*.

He was interrupted by a full hearty laugh. "I already know about your ship, Mr. Adams," the Prince said. His voice was deep and rich, with an almost perfect Oxbridge accent. "You must remember that Fiji and Tonga have been close neighbors for centuries, and we have many friends there. My people sail to Fiji whenever they like."

"I thought you would know, Your Highness," Adams said. The amused glint was back in his gray eyes. "But I wonder if you know the consequences of that?"

"Damned awkward for your company, I think," the Prince said. His voice lost the amused tone, became stern. "For us, too, perhaps."

Adams nodded, turned to Mike King.

"Yes, sir," Mike said. "Overseas Foods wants the Station. They've got enough of our bonds and preferred debentures to get it. We might be able to keep the reactors, and then again we might not, but they definitely want the rest of the Project. Except for the whales which they consider an unnecessary expense. They'll butcher them."

"Susie!" Courtney exclaimed. "But you can't let them do that, we're just beginning to—we might even be able to have them bear young, save the species . . ."

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"Aye. And before they can be killed I'll turn them out myself," Dr. MacRae added. "Nae matter what Mr. Lewis says, but I think he'll nae forbid it. I hae never met the chief but I'm told he loves the whales . . ."

Prince Toki nodded agreement. "I think even if you did not, Dr. MacRae, the sea people would release the whales. By the way, I'm surprised you've never met Mr. Lewis. But then I haven't either." The simple statement was a demand for explanations.

"Never come to Tonga," one of the councillors said slowly. "Must be a very stupid man."

"No, sir," Adams told them. "Mr. Lewis is crippled. He never leaves his headquarters in Santa Barbara."

"I see," Toki said. "I had heard something of the sort but . . . well, sir. We are agreed that we have common interests. Now what is it you want?"

Adams looked surprised as if the Prince's bluntness was unexpected. "Let's be sure we do agree," he said slowly. "The Project is going well?"

Martinez answered quickly. "Very well. I am astonished at how quickly the Tongan fishermen have learned the techniques of scientific record keeping. They'll have no trouble operating the farm projects so that the Station can be manned with few non-Tongans, as agreed in the sale."

"A gentleman's agreement only," the Prince said. "Quite unenforceable but I am happy that you have voluntarily kept to it."

MacRae was muttering to himself. "'Twill be a pity to see the Station go to people like Overseas Foods, they've no sense for the future. And 'tis a bonny project."

"There's no hope, then," the Prince asked carefully. "Nuclear General is in that much financial difficulty?"

"Without the plutonium aboard *Persephone* we are," Adams answered.

"Of course you wouldn't be talking to me if your government were willing to help get it back," the Prince said. "All right, Mr. Adams, you've an idea, what is it?"

Martinez laughed and everyone looked at him. "I don't know what he has in mind," Martinez explained quickly, "but one thing I've learned, never count Mr. Lewis out until he's not only dead but embalmed. Not even then. *El Patron* has won tougher fights than this." He gestured significantly at Bill Adams. "And we know he is concerned, to send his prime minister."

Adams gave Martinez and the Prince a twisted grin. "He's worried all right." He took a large chart from his briefcase, spread it on the table. "*Persephone's* here?" he asked the Prince.

"Yes."

"Aye," MacRae answered. "In that harbor, protected by the entire Fiji Navy, all seven gunboats and a destroyer."

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"With radar scanners, I suppose?"

MacRae nodded.

"You've said that the Tongans sail to Fiji, Your Highness. Even in bad weather. In open boats, small outriggers. Is that true?"

The Prince grinned carefully. "It's true enough, Mr. Adams. We have sailed those straits for hundreds of years. I've done it myself often enough. I suppose you've thought of underwater approaches?"

Adams found it was his turn to laugh. "Yes, sir. My company police say the harbor's too treacherous for frogmen. We might train the dolphins, but there's not enough time. On the other hand, our people say the chances of a small outrigger being picked up at night during a storm are just about nil. Of course, no westerner would be able to navigate an outrigger into that harbor under such conditions . . ."

"What will you tell the Republic of Fiji if this succeeds?"

"Why, that we found our ship adrift and unmanned in international waters," Adams said. The grin was back now, Martinez thought his friend looked quite himself. "We'll even offer to pay a reasonable fee for 'caring' for *Persephone.*"

The Prince's laughter rumbled through the room. "All right, Mr. Adams. We'll help you get your ship back. I've heard of Overseas Foods and I don't want them for neighbors—but none of us could sail her, I think. I'm sure there are no Tongans who can operate a nuclear reactor aboard ship. Or probably anywhere else."

"I will take care of the reactor," Art Martinez said. "I may be an ecologist, but I am Director of San Juan Capistrano Station. I know how."

Adams nodded. "And I can sail the ship if you get us to her, Your Highness. I also have a couple of sailing officers from Company headquarters in *Cerebrus*'s staterooms. If you hadn't been willing to help, we'd have had a crack at it alone, but welcome aboard!"

Cerebrus landed in the lee of an uninhabited atoll seventy miles from Fiji. Her clamshell cargo doors opened to discharge men and a slender war canoe.

"Now we'll see how it floats," Prince Toki said. "I wonder that you made your own."

Adams shrugged, then quickly grasped the handrail by the cargo door as the plane lurched to a heavy sea.

"Fiberglass is a bit tougher than your woods," he said. "But this outrigger is an exact duplicate of the one in our harbor. And remember we won't be bringing it back with us. This one can't be traced."

Toki laughed softly into the gathering dark. "You hope it won't be coming back . . ." They climbed gingerly down from the enormous plane to the pitching boat. It was only three feet wide, but nearly fifty feet long. All metal tools and weapons were laid in the bottom of the

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boat so they would be below the waterline and out of radar reflection.

"As soon as you're ready," the pilot called softly. "That blow's coming up fast and it's getting darker. I'd like to get the old dog upstairs."

Adams waved. The props spun, and *Cerebrus* drifted away, turned and gunned into the wind. Spray flew from her bows and pontoons, then she was aloft, winging just above the tops of the waves. They'd come in at the same altitude.

The boat wallowed heavily in the rising seas. Prince Toki stood in the stern, spoke quietly to the sea people. Except for a half dozen technicians and company police, Adams, King, and Martinez were the only westerners. Adams hadn't objected to the Prince coming himself; he understood why. It would not have been in a warrior aristocrat's character to send men on something like this and not go himself, even if the Tongan royal family hadn't led men in battle for a hundred years.

The Prince's teeth flashed white as Toki spoke carefully in musical tones, his voice carrying easily over rising wind and crashing waves. When he sat again they cheered.

"What did you tell them?" Adams asked, but the Prince had gone forward to see to the sails. The outrigger gathered way under sail, flashing across steadily rising seas. When they left the lee of the island breakers crashed around them, but no water came aboard. Adams estimated their speed at twenty knots.

Toki came back finally after inspecting sails and rigging. "I told them of their ancestors and mine," he said. "I was named for one, Toki Ukamea means 'iron ax'. We once sailed these waters in revenge against raiders. I could have told them in English but—it sounded better in Tongan!" There was amusement in the clipped accents. "If my professors at Magdelene College could see me now!"

The boat was pitching wildly, and the Americans found it hard to pay attention to anything. The storm rose, wind howling until the Tongans reefed, reefed again until the sail was a tiny patch in the night, but the boat tore on at high speed, leaving a great creamy wake behind, actually outrunning the seas, carried along by the screaming wind.

"Quite a blow," Michael King said. His voice was strained, artificially calm.

"Not really," Toki answered. "You will know it when the storm really hits. There will be rain then. I warned you . . ."

"Yeah." Adams grimly held the bulwarks. He looked behind, saw an enormous wave building up astern, flinched, but they ran away from it so that it broke harmlessly aft of them. Another monster sea came up, with the same result, but it was unnerving to watch them. He tried to close his eyes but his stomach heaved and he quickly opened them again, grimly took a deep breath and held it.

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"At night, with this storm, there shouldn't be anyone very alert," Adams told the Prince. "I hope."

Toki shrugged. "Fijiians might, but I do not believe their Asian masters will let them out in boats." Mike King looked up in surprise, and Prince Toki grimaced. "Malays, Indians, Chinese—they outnumbered the Fijiians as far back as the late Fifties. We would have gone the same way if we ever let the Europeans control us. The Indians came to Fiji as workers, so did the Chinese. Soon there was no room for the sea people. Our King George Tupuo I kept Tonga for the Tongans. A wise policy, I think."

Adams looked at the enigmatic face, wondered if there were a message addressed to him. His wits weren't sharp, not in this wild sea and screaming wind.

Prince Toki read the expression, smiled thinly. "No, I don't mean your Company, Mr. Adams. I was worried at first, but you have kept your agreement, brought in only enough westerners to run the Station, kept them on short-term contracts. If you had encouraged your people to settle permanently . . . but do you know why I agreed to help you tonight?"

Adams shook his head warily.

"The whales. The sea people have always respected the whales, Mr. Adams. It will be a sad world for us when they're gone. But there's nothing we can do to keep the powers from killing them all off. Your Company is at least trying."

"Be damned," Adams muttered to himself. Had Mr. Lewis seen that coming, or did he really just want to save the beasts for sentimental reasons? No matter, the books balanced nicely now . . .

"Understand me," the Prince was saying. "We can help each other, and the reefs you occupy would never have been much use to us. You can keep them. But I hope you have no other plans for Tonga."

"We don't," Adams said. At least none I'll talk about now, he added to himself. A thick cloud had moved over the already feeble moon, and it was dark and threatening in the open boat. Phosphorescent seas crashed around them and the ominous black clouds astern gave an atmosphere of indescribable menace. Bill settled his windbreaker around himself and stared miserably at the water.

In four hours they were at the harbor entrance. A driving rain obscured everything, and Adams was amazed at the skill of the Tongan helmsmen who seemed to know exactly where they were. They had sailed to Fiji many times across hundreds of miles of open water, and they had phenomenal memories, but there was no clue to what they steered by in this wet darkness. A tiny reef to port, swirls and breakers in the water, the sound of surf crashing in the distance were enough. The boat raced on past the harbor bars in silence, and they were in calmer water.

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Then, quite suddenly, a white shape loomed up off the starboard bow. *Persephone*, riding at anchor, tossing violently in the big swells that swept in from the Pacific. Even close up the ship was hidden in the driving rain.

The boat moved quietly to the anchor chain and Prince Toki, followed by three Tongans, swarmed up it. Moments later a dozen followed. Adams heard a scuffling sound, a noise as loud to him as *Cerebrus*'s engines had been, then silence. A few moments later grinning bronze faces peered over the bulwarks.

More Tongans climbed the anchor chain, and one fixed a rope ladder to the ship's rail, tossed it down. Adams climbed painfully up to the deck, Martinez and the technicians coming behind him. The Tongans were holding limp Chinese figures near the ships cabin, and Adams looked inquiringly at Prince Toki.

"They'll have headaches in the morning. What do we do with them?"

"Set the lot of them adrift in the canoe. Only anchor it so they won't get lost." Adams said. Despite his seasickness there was a wave of triumph swelling over him.

Toki nodded. "Ready to be cut loose?"

"I think so. Give us a couple of minutes, eh?" Martinez was already below in the engine rooms with technicians. It would be an hour before he could safely start the reactors, but the ship's emergency batteries ought to be able to take them out of harbor. Adams and a company sailing officer went to the bridge.

"Everything looks good, sir," the mate said. "Plenty of juice. I think we can put out."

"Do it." As *Persephone* moved silently out of the harbor and into the storm Adams grinned despite the violent motion. He was miserable, and when it was safe he'd lose his dinner, but he had the ship. And that's half the problem, he thought.

The fiberglass lanai set on top of the Station blockhouse seemed like home after the wild ride. *Persephone* had met *Cerebrus* after the storm blew itself out, and a regular crew took over. Bill and the Tongans returned to Ta'avu Station while the big white ship raced out to open water escorted by the plane. She wouldn't be taken again.

Adams carefully squared the stack of papers on the table, placed them in the briefcase. He fussed with their order, being sure that he knew where each was so that he could get what he wanted without hunting and without opening the case wide. As he finished Courtney came in.

"The Prince and his councillors are in the conference room," she said. "They're ready."

"Thanks."

"That was . . . well, congratulations," she said. She wanted to say more but he had that preoccupied look again. She wished he would notice her, but now she un-

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derstood. There was something else, and after that there would be another problem. There would always be another problem for a man like Bill Adams.

"What's that you're carrying?" Bill asked.

"Oh . . . one of Mike King's books. He loaned it to me." She held out Bernstein's classic "Transportation Economics." "I thought I ought to study something besides Station ecology . . ."

"Yeah. Keep reading things like that and . . . look, after this is over we'll see about that transfer of yours. You like to travel?"

"Yes . . ."

"I'm leaving Mike here when I go back to Santa Barbara. Maybe you could come with me."

Prince Toki and his two councillors were seated at the conference table. They stayed there as Bill came in and he remembered that to stand in the presence of nobility without being asked was considered disrespectful. Evidently he'd been promoted. He shook hands around and took his seat. Everyone grinned openly.

"Perhaps not a feat to compare with the early Kings," Prince Toki said, "but wait until the palace musicians are through. You have no idea how strange 'Bill Adams' and 'Arturo Martinez' sound in a Tongan heroic ballad!"

"I'm afraid to guess," Adams said.

"Where is Dr. Martinez?" the Prince asked.

"Some kind of problem in the fish farms," Bill answered. He looked around. Even Courtney was gone. "I'm sure it's not serious. Well. Gentlemen that turned out well enough. Now let's talk about the next problem. The Fijiians are stealing your fishing boats. Your waters, too. I expect you want to do something . . ."

Toki nodded. "But I wish you would stop saying 'Fijiians'. It isn't the sea people, it's the mainlanders who are pirates."

"I'll try to remember, but what do I call them? Anyway. Let's do something about your boats. What Tonga needs is a real navy, something to protect your waters."

Toki shook his head slowly. "Frankly, Mr. Adams, the cost of a navy would be greater than all the fishing boats we'd ever lose. Besides, no matter what you saw last night, our people don't enjoy fighting. The real Fijiians are more warlike than we are."

"Not true," the older councillor said. "In older times we fight. No one ever conquered Tonga Islands, we have always had our own King."

Toki shrugged. "Still, we're not about to convert to a war economy. And war with Fiji would take time, kill a lot of sea people. No."

"Oh, I wasn't talking about Fiji," Adams said. He flashed a crooked grin. "Now that we have *Persephone* back we can put a stop to *that* nonsense through economic pressures. It shouldn't take long to settle Fiji."

"Then why do we need a navy?"

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"Funny thing about this world," Adams said carefully. "Legally, a sovereign government can protect its interests pretty well as long as it doesn't start open war and involve the big powers. Certainly a sovereign government can arm merchant ships and protect them from harassment by international gangsters. But there are a lot of sovereigns in name who haven't the means to protect themselves and have to rely on . . ."

"You mean Tonga," the Prince said. He frowned, then shrugged. "But I must agree. We wish the British were still protecting us. But they're not, and we see no one else we'd like to have as partners."

Adams nodded. "Now also in this world are big companies—like, say, Nuclear General—who have more than enough power to protect their interests but have no legal right to do it because they aren't sovereign. The United States is supposed to look after our interests, but we don't see them doing much of it. Delicate state of relations, world opinion—" Adams broke off, his jaw set. "Mostly lack of ability, of course. With welfare payments where they are the U.S. can't even do proper research, much less . . . well. If Tonga were to nationalize some of Nuclear General's ships, you'd have the right to arm them, declare them protected by your sovereignty . . ."

"You're asking us to expropriate your property?" Toki asked.

"Well, we'd expect to be paid."

"We don't have money to pay . . ."

"You'd have enough money if you leased the ships to us. We'd pay very well for their use. At least as much, say, as we'd have to ask for if you nationalized them."

A slow grin spread across Toki's bronze face. "Let me understand something. Does your offer to help with Fiji depend on this deal?"

Adams shrugged. "There could be even more to it than that, Your Highness. For instance, Tongans go overseas to university. I suppose some of your people have overseas property. But you have no resident ministers or consuls abroad . . . now Nuclear General has people all over the world. No reason why they can't be given diplomatic credentials by the Royal government of Tonga, is there? Of course we'd have to look out for your interests . . ."

"I will be—" Toki broke off, spoke in Tongan. The ministers laughed. Toki turned to Bill Adams. "It seems we could use this arrangement to capture and protect more whales, stop foreigners fishing in our waters . . . would you agree to that?"

"Of course."

"What do you want, Mr. Adams?"

"Nuclear General has an ice floe in the Humboldt current," Adams said. "It's being towed up to Los Angeles, where we can sell it for quite a lot. But a couple of South American governments think they can charge us enormous fees for passage through what they call their waters. Now, if we arm those ships and bring the kind of economic pressures

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that we can swing, we can talk them out of their designs. But our State Department won't let us do that, and the U.S. Navy won't act to protect our property. If we register those ships under the Tongan flag . . ."

"I see." Toki was thoughtful for a long moment. "But this might mean war, Mr. Adams."

"Not over the ice floes. As to something else, how safe would you be? If Nuclear General is really in trouble, we'd have to pack up the reactors and go. Or lose them to someone else. That's not a threat, Your Highness. I know better than that. I'm trying to point out that Ta'avu Station is valuable and one of these days we may have to fight for it. The decision to try to take it from us will be harder to make if the fight won't be easy. *We* can't arm the Station; we're not sovereign. You can't; no weapons. Together . . ."

"How would you arm Ta'avu?"

"Coastal batteries. We've got some. Also we've got a couple of warships we bought from bankrupt governments, we can keep them around here under your flag if you'll commission our officers. But there's something else . . . it's widely known that Nuclear General has the knowledge and fissionables to make atomic weapons. If we're acting for you, whether we have them or not I don't think small powers will want to find out—and the big ones won't bully Tonga while they'd be happy to push a U.S. private company around."

"Why us?" Toki asked quietly.

"Because you're not ambitious. We've no worries that you'd try to use the Company as a lever to conquer your neighbors. And the whole world will believe that, there's strength in being thought small and nonaggressive in this day and age. Especially if you've suddenly joined the nuclear club—"

Toki pursed his lips carefully. "I'll have to speak to His Majesty, but—the idea is appealing. Tonga needs powerful friends, and I think your interests are close to ours. We'd thought of alliances with other countries but we . . . I suppose you have an agreement with you?"

Adams nodded happily. "It's rather complete, actually. With some long-term taxation agreements which will infuriate the U.S. Internal Revenue Service but ought to make you happy . . . now we expect you'd rather collect most of those taxes in services, here's a schedule—"

He was interrupted by Courtney and Danual bursting into the meeting. Adams frowned as the Tongan technician squatted respectfully before his Prince. They chattered in Tongan while Adams looked on puzzled and Courtney tried to look casual although she was obviously bursting.

Toki's grin was reassuring. "Dr. Martinez sends a message which won't wait, Mr. Adams. You are to congratulate Mr. Lewis and tell him he is the father of a three-ton baby girl . . ." ■

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Truck Driver

A functional spacecraft by its nature has some powerful—though not obvious—weapons to use!

by ROBERT CHILSON

Ynga Lancaster hobbled awkwardly in her skintight pressure suit. It was inflated, so it didn't as yet grip her any more tightly than a stretch coverall, but the pads that filled out the concavities of her figure hampered her motion. Worse, they rounded her excellent figure out into that of a clumsily-carved doll, one with features barely suggested.

Carrying her helmet under one arm and her flight orders and purse in the other hand, Ynga pushed open the door onto the ready line. It was chilly outside, with a hint of snow from a lowering sky. As a veteran pilot, her bird had been moved up near the building. She hurried toward it. Her pressure suit was permeable, designed to permit her to lose heat; and it wasn't designed for such extreme conditions as this. Though only a little below freezing—hot by the standards of shadows in space—the dense air carried her body heat away fast enough to make her shiver as she hobbled over the tarmac.

By earlier standards, the bird was a big one. It was a nuclear-electric aerospace plane capable of putting a hundred tons, not into Earth orbit, but into escape trajectory. In shape it was an arrowhead, with the trailing points extending somewhat behind the tail of the "fuselage". The main body, or fuselage, of the plane was perhaps half the wingspan; from there the wings thinned toward the tips. At the tip of each wing was a double electrojet, one above the other. These ramjets were each big enough for a man to take a running dive through without touching—and electrojets are vastly more efficient than thermal jets.

Along the leading edge of the wings were smaller jet intakes; the little electrojets that sucked air in to lift the wing. They could support the plane on hover with small or no load, or on air cushion near the ground with full load. Aft, on the trailing edges of the wings and body, were the exhausts of the turboelectric jets that were used near the ground.

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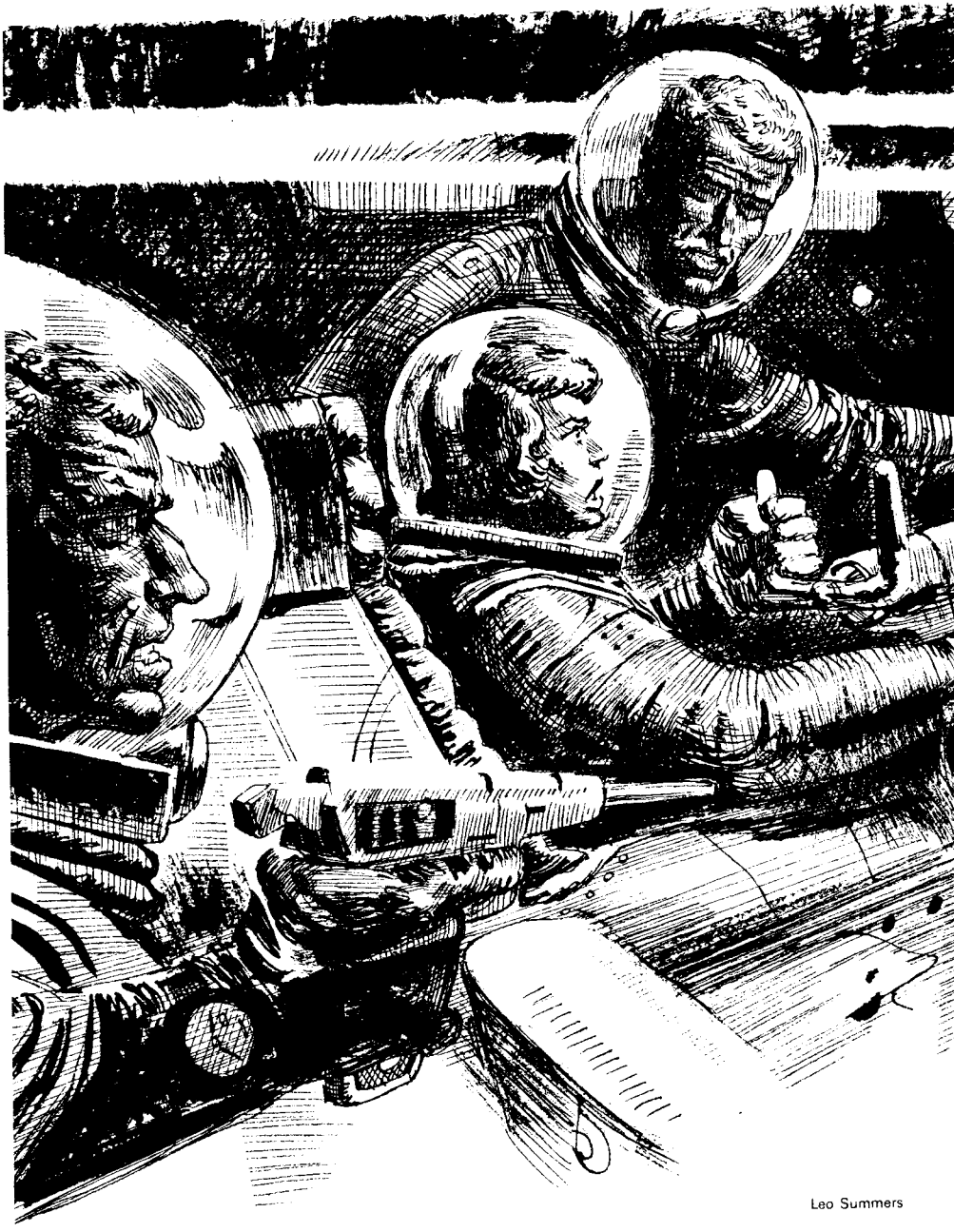

Leo Summers

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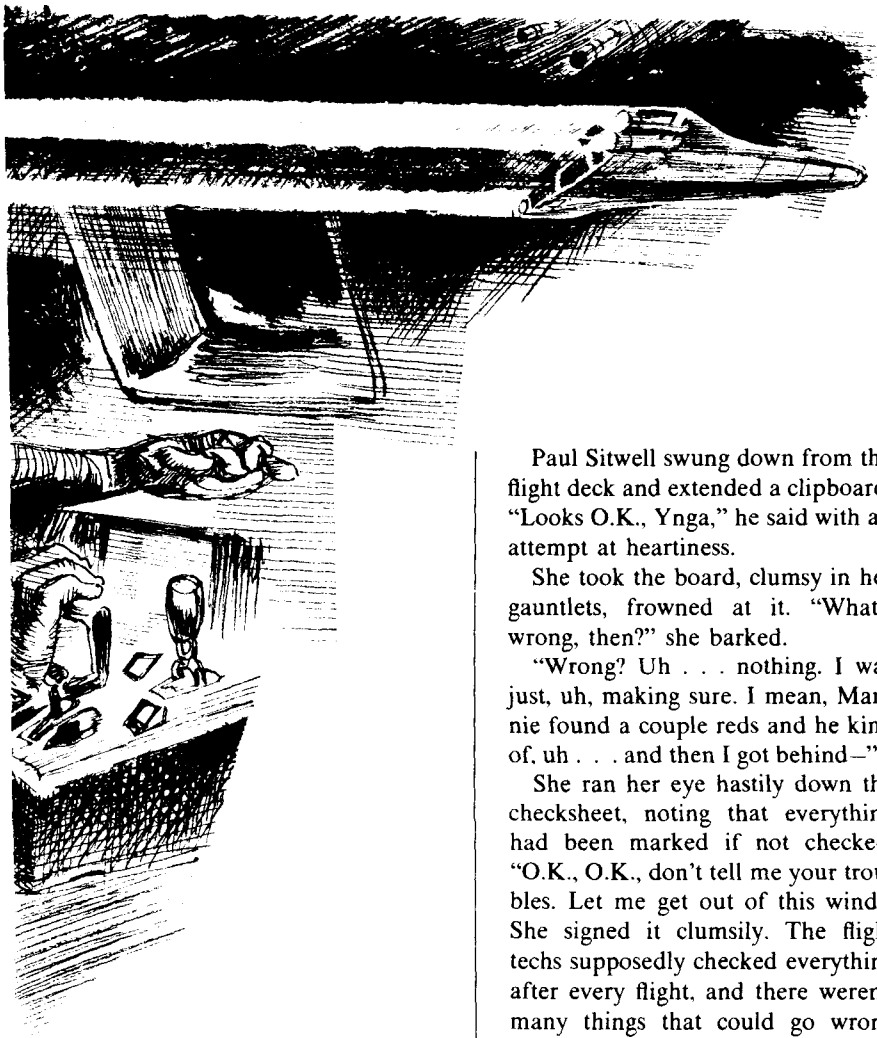

Paul Sitwell swung down from the flight deck and extended a clipboard. "Looks O.K., Ynga," he said with an attempt at heartiness.

She took the board, clumsy in her gauntlets, frowned at it. "What's wrong, then?" she barked.

"Wrong? Uh . . . nothing. I was just, uh, making sure. I mean, Mannie found a couple reds and he kind of, uh . . . and then I got behind—"

She ran her eye hastily down the checksheet, noting that everything had been marked if not checked. "O.K., O.K., don't tell me your troubles. Let me get out of this wind." She signed it clumsily. The flight techs supposedly checked everything after every flight, and there weren't many things that could go wrong with a nuclear-electric bird. Paul's job was merely to eliminate the waste of pilot hours in final checkout.

She swung gratefully into the warm bird.

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The name of her plane was *Rival.* She looked around, soaking up the warmth for a moment, the comfort of her homey touches as warming as the plane's air-conditioning. Bill, her husband, bless him, was not disturbed by the place of her birds in her life. She had added her own decorator scheme to the switches and buttons—in nail polish. The go-stick wore ruffled skirts, and a pair of Pete's baby shoes, gold-plated, hung from it where it extended from the board. She'd have had a picture of the two of them if there'd been room.

Activating the board, she gave the bird a spot-check, checked communications, told the voice in the tower that, yes, she had clipped her purse under the seat, made him admit that he had neglected to clock the fact that she was flying alone as usual, and switched on the visiplates. These birds, like all modern planes, had no ports; her view came from numerous thimble-sized ikons scattered over the hull in strategic places.

"*Rival* ready for the flight line," she informed the tower.

"So O.K., get that female kite out of the way and let a man through," Ernie Katz insisted.

Ynga grinned, seating her helmet and checking it. Ernie's bird was dubbed the *Manpower;* he even had a big UP sign painted on it.

Rival lifted a little as the jets along the leading edge pulled air in from above and blew it out below. In moments it was on air cushion. She halted its drift on the wind with the turboelectrics, turned it toward the flight line and wafted it along as gently as a leaf. Receiving final clearance, she tipped over the edge of the gentle ski-jump slope and blasted all the secondary jets at full.

By the time she had reached the bottom of this slope, *Rival* was airborne, definitely off air cushion, winging uncertainly over the east Texas flatlands like some misplaced condor. Its sharp nose and edges and extreme lines marked it as no submach barge, but a true eagle of the ionosphere, and it looked oddly out of place so near the ground.

The ground fell rapidly away, however, and by the time she crossed the Gulf Coast into cold winter sunshine, Ynga was ambling southeast at a leisurely 600. She concentrated on building up altitude. *Rival* had automatically throttled back on the jets that supplied lift to the flying wing, and they were now off.

A hundred miles or so south of New Orleans—half an hour from Galveston—Ynga had made 50,000 feet of altitude. She hauled *Rival* around to the south and glanced back in the side-mounted jet-view 'plates as the shock-diffusion pods were retracted from in front of the giant ramjets. They had been fully extended and the jets blocked off to reduce drag. Now, for submach speeds, they were fully retracted.

A good six hundred miles per hour was more than fast enough to fire the

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big jets, even in air this dense. She hit the igniters and tensed involuntarily. The gale of dense, cold air howling through them had to be ionized and utilized in the split fraction of a second it was passing through.

The multiple electron-beams, wrapped in concentric circles around the throats of the jets, started it. Their beams only penetrated air for a fraction of an inch—but that fraction was heated hotter than the solar surface. Air at that temperature is ionized, a plasma—and plasmas are electrical conductors. Behind the electron-beams was a magnetic pinch. When a conductor enters a magnetic field, it is constrained to move, and this field was circular. The thin circle of plasma was forced inward, compressing the cold air within it to 15,000 degrees Fahrenheit. It came out of the exhaust much faster than it went in the intake, and the thrust was unidirectional; no nozzle was needed.

Rival vibrated to the four-fold kick of the big rams and Ynga relaxed; all had fired in the same quarter-second. She pulled the go-stick definitely back and headed for the high side of the atmosphere. At this level, there was no small danger that the dense air would blow out the jets. But by the time she had put another fifteen thousand feet beneath her, it was safe to go super.

Ynga clamped down on the throttle and grinned inside her helmet as the monster rams thundered. Pressure built up on her chest, and, flying by feel, she pulled back more on the go-stick.

Rival vibrated faintly and the thunder abruptly dropped to a murmur, almost a purr. Ynga held the stick back for a long time, topping out at 100,000 feet and 5,000 miles per hour. Very little sound was transmitted to sea level from this altitude, even at this speed and with this mass of plane. She held her speed down to a conservative level, though, until she had passed the tip of Florida.

Here she was treated to a *real* sight. Many big birds congregated here, thousand-ton aerospace planes, that took but an hour from takeoff to touchdown on an antipodal flight. They only went suborbital, and their ammonia tanks were frequently untouched on landing. But they could, with effort, put their full load in low orbit. At her speed she saw only those going her way at near her speed. She was on the Gulf leg of the equatorial flyway, and quite a few were going her way: trucks taking up raw materials to the factories in orbit.

They were slower on the start than *Rival*, however. She walked away from them, doubled her speed, added another 25,000 feet of altitude. Over the equator, she pulled back again. Climbing no faster than she had to to keep her jets firing, she racked up speed. At 15,000 miles per hour, she was unable to hold *Rival* down. The eagle had its eye set on near space. Centrifugal force alone

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threw her out. She fired her jets until they began to heat up from lack of working fluid; at the end they were firing at near 25,000 degrees.

The whole plane seemed to go limp when the big rams finally shut down. The Indian Ocean was just coming in sight past Africa. Ynga stretched, trying to relax. She checked a number of trouble spots, verified her course on the flight orders, reported again to flight control, settled back to wait.

It didn't take long. She was in suborbital flight, but there was no point in burning fuel near Earth. By the time she had half circumnavigated the planet she'd be at apogee. She'd "burn" enough of the ammonia in her wing tanks to round out her orbit, wait half an orbit, and fire again to escape velocity and over. That would put her in Earth's orbit at less than orbital velocity—falling inward toward the sun. It'd take quite a while to impact on it, but she only intended to stay in that trajectory long enough to dump her load and pull out.

She'd been flying these radioisotope disposal drops for almost a year now. On the whole, she liked them, though they put her on overtime. Since they had been allowed to switch to one driver per bird, she only had to work the usual four-day week.

Being alone thus, Ynga was understandably startled when a hand reached past her to switch off the radio. She twisted around and had her eyes caught by a black hole in a very businesslike pistol.

The man behind it was in bulky space armor, not a skintight pressure suit. He grinned past a mustard-yellow moustache, his helmet transparent.

"Sit easy, Ynga femm," he said.

Motion caused her to twist in the other direction. Another man, smaller, also armed, was coolly seating himself in the copilot's chair. Mustard-moustache took the astrogator's seat on her right.

"Hot jets," he said sardonically. "Very. But we'll take it from here. You just have to follow orders and leave the worrying to us. Oke?"

She stared steely-eyed at him.

"Don't try anything funny, Lancaster," said the smaller man sourly. "We weren't born yesterday. Your husband, Bill, and the boy will answer if you do."

Ynga had to fight emotion for several seconds, was unable to speak—though not unable to note that the man was ignorant of the finer details. It suggested that he'd merely been briefed—and that there were a number of men in the gang. It was a well-laid plan—

"That's the trick, femm," said mustard-moustache, grinning confidently at her. He had rugged good looks, was too aware of it, too happy to have her at a disadvantage. Probably he even had one of those lapel pins under his sparmor: UP with Manpower.

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The smaller man was the head, and the more sinister. Of course they were professionals, for hire. International business was a violent game. Though what corporation would want to steal a small aerospace truck like this was more than she could guess, or why. But she couldn't risk anything. These were pros. They'd keep their word.

"Give 'er the course, Joel," said the small man.

Joel tore her flight orders out of the holder and inserted his own. His clumsiness in his gauntlets—which he removed—and his general air of fumbling told Ynga that he was a stranger to flight decks, though he seemed to understand astrogation.

Ynga was only a truck driver herself, and knew only the basics, but as he explained the course, she understood. They proposed to fire at apogee of the present orbit, continue to fire for a quarter-orbit at low thrust, then fire hot, to escape velocity. There they'd dump the load.

That was dangerously close to Earth, though the quarter-orbit on low thrust would take them out a bit. Point was, they'd be adding to instead of subtracting from Earth's solar orbital velocity, dumping on the wrong side of the planet. The load of radioisotopes would fall outward, not inward.

How far she had no way of knowing, or where it would wind up. But, of course, it wouldn't be permitted to go far. In fact, a ship was probably already drifting along on a course that would take it near the load's orbit at the right time. That'd have to be within reach of its lead-"burning" electrorockets; they wouldn't dare go to fusion drive so near Earth. Fusion rockets had disastrous effects on the electromagnetic atmosphere, and it was illegal to use them inside Lunar orbit.

"What about—" she had to clear her throat. "My husband—?"

Joel laughed snickeringly.

The small man said, tonelessly, "A couple of the boys have him and the boy. They'll hold 'em until they hear from us, or until a certain time has passed. Don't worry."

Don't worry!

Joel asked her the ship's take-off weight. She told him, adding numbly that she hadn't used any ammonia yet.

They sat, or floated, while *Rival* climbed silently upward as on some monstrous updraft. Ynga ignored Joel's sidelong glances and tried feverishly to think. They'd have her land the plane somewhere, and hold her until the ship had time to recover the cargo.

No doubt her trajectory would be traced when she varied from her flight plan, but the officials wouldn't think of following the load. They'd be concentrating on the plane.

They might be held quite a while. The load would have to be well away from Earth before it was approached. They might well simply kill her and Bill and Pete rather than hold them so long.

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Joel hadn't put his gauntlets back on. And they were wearing armor instead of pressure suits. If she could spill cabin pressure quickly enough, bends would tie them in knots. They were breathing nitrox by their voices. Her own pressure suit was molded of expansion fabric. Every fiber of it was a miniature balloon, open at one end. Under one atmosphere all were fully inflated, somewhat larger in diameter and quite a bit longer. As pressure dropped, they'd deflate, shrinking down to their normal size. At zero, they'd supply nearly an atmosphere of pressure. She'd scarcely feel a sudden drop—if it could be arranged.

"Does everything check out?" asked the small man with a hint of nervousness.

Ynga grinned inwardly; he'd been watching Earth shrink below them. Doubtless he'd been Out before, but it wasn't as immediate as this.

"Sure, weight's right on the nose, we're right on the curve they said," Joel told him absently, familiarizing himself with the astrogating instruments.

And with a sudden swoop of her stomach, Ynga had it.

Her hands were sweating in their gauntlets as they approached apogee. Her tension was not noticed by the hijackers; even Joel had finally given up his scrutiny of her for the majesty of space. They were approaching the night side of the planet, "twelve hours" from her takeoff point, but well off to one side. The sky immediately ahead and above them was that of midnight on Earth.

"O.K.," said Joel finally. He gave her the thrust figure again, set the bird's attitude himself—he had to have help in turning the plane, but he worked the instruments fairly well. Then he checked everything between glances at the visiplates while the small man fidgeted silently.

Joel gave her the go-signal from his own chron.

Ynga obediently hit the ammonia-tank heaters, followed through with the ramjet ignition sequence, then deliberately went around the board, hitting everything that would make a display. The board lit up like a caravan of Christmas trees. Joel and the other stared, bewildered and more than a little frightened.

She grinned a little, weakly, inside her helmet. Their expressions were much like Bill's when she tried to explain the workings of the aerospace planes that were her life, except that he usually looked bored. And he taught nuclear engineering at the General Nucleonics College.

The transmitted vibrations of the big ramjets, now rockets, hummed around them. Ynga's flying fingers touched the ammonia-tank vent-alarm cutoff, her stomach a ball of tension. Would it work *before* the alarm sounded, prevent it from sounding?

It did. She must have hit it just before it went off. She suppressed a sigh.

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The red light flashed, of course, but so were plenty of others. She'd just have to keep them all flashing all the time the rockets were on.

Joel had given her a clear course through the Earthbelt, though they came closer than Ynga liked to half a dozen factory complexes. Space was crowded so near the planet, not merely with the factory and space city and amusement complex traffic, but with traffic from Luna and the asteroids as well.

Joel had taken possession of the radio switch, which he kept firmly off. It flashed angrily, adding its mite to the chaos of the board. Ynga's jaw set hard.

The sound of the rockets drowned out the hiss and thrum of escaping gas from the ammonia tanks.

The minutes ticked past like hours, but it was not long before Joel nodded and said, "O.K., up with her!"

Ynga pulled back and squeezed the throttles harder. *Rival* pulled directly away from Earth under three Gs, losing ammonia at a frightening rate. Ynga switched to space-scan radar and clidar. So far she didn't see anyone after them. But they couldn't violate all the rules, regs, laws and international agreements like this and get away with it.

Joel and his boss understood that as well as she did, and they were even more anxious to make it a quick flight. Their flight plan allowed for that. They weren't adding as much to Earth's velocity as Ynga usually subtracted on these flights. The load would drift outward slowly.

Ynga's thoughts kept straying to Bill and Pete. She couldn't stand much of that. Fiercely she concentrated on her own situation. She couldn't think of a thing that would be worth all this trouble to smuggle off Earth. Furthermore, every canister was carefully checked before it was sealed, and if it wasn't radiating, it'd look odd, to say the least. So, what radioisotopes would be valuable enough to warrant so much trouble?

Most big power plants were fusion. Small power plants, such as *Rival*'s and her car's, were charged-particle nuclear-electrics. They used lightweight isotopes such as Carbon-14 and Strontium-90, subjecting them to terrific electromagnetic stress to cause them to break down at an accelerated rate. Isotopes with half-lives in the thousands of years could be burned out in a decade.

Such power plants were very cheap, because the fuel isotopes were easily made. Her cargo was supposedly of such spent fuel sticks. The only difficulty with them was that, though isotopes varied, alpha-emitters—alphagens—generally took a different excitation stress than betagens. The two couldn't be mixed in an "alphabetagen" with any degree of success. That was unfortunate, because the number of compounds that could be built could have been greatly increased. The fuel elements had to have the right

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electrical and mechanical properties as well as nuclear.

That left only the fissionable isotopes and gammagens.

Fissionables?

But fissionable power plants were far more expensive and far less efficient. The electromagnetic excitation used on alphagens and betagens didn't work on neutrons. The only thing they could be worth stealing for was bombs—

Burnout!

Ynga took a quick look at tank pressure and saw with a catch of her breath that they barely had fuel enough to get them back—empty. She switched off the tank heaters quickly, shut down most of the other displays. Then she hit the switches that opened the hatches. The loss of ammonia stopped when the heaters went off.

The big hatches were located between the giant dorsal fins that divided the flying wing into thirds. There was a row of smaller hatches outside these fins, but she left them shut. Radioisotope disposal was a bulk job, and her hundred tons had been made up in the big holds. When all these hatches were up, the ship had two more lines of fins running down its back. Ynga checked visually to see that all were all the way up.

Nodding absently, concentrating hard on her job to still her quaking spirit, she reached for the small rocket controls. These were designed to save bird turnaround time in space when bringing up cargo to factories. Blasting these tiny rockets caused *Rival* to move slowly, grandly "down" from under its burden. The cargo outweighed the bird itself by a large margin.

Once away from the big canisters, which began to spread slowly apart, she rotated *Rival* slowly on the gyros. "Upside down" and flying backwards, she warned them and fired the big rockets again.

She gave them ten Gs until she began to get hazy. Her captors blacked out—neither of them knew enough to have connected up the anti-G bands. The smaller man took it better; smaller people can take pounding better than big ones. One reason Ynga had made space pilot. But she was a good-sized woman, every bit as big as this small man. At a guess he could take as much as she.

He was a suspicious devil; he had a gun and a gimlet eye on her the instant his vision cleared.

When Joel awoke he turned ugly. The idea of blacking out while a woman held out didn't sit well with him. He said nothing, but he had no time to spare for the spectacle of the milk-shot blue planet swelling before them.

"Tell her where," ordered his boss.

Joel sullenly told her to put them down over the South Pacific and they'd tell her where from there. Sidelong glances told her he had his own plans after that.

Now that it was done, Ynga was

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weak and quivery. Her mind, hazy now, was full of Bill and Pete. Their freckles, engaging grins, and that little gap between their front teeth. Would she ever see them again?

These were professional industrial goons—spies, saboteurs, guards, or musclemen, as indicated, she thought feverishly. Industrial competition was cutthroat, but person-to-person violence tended to be avoided. Reprisals were too easy. They were out of practice. But Bill was only a professor. He wouldn't stand a chance against this kind of pro.

She remembered his earnest head bent over a nuclear physics journal so intently he never noticed the blue smoke pouring up from the defective toaster and hanging under the ceiling. He even wore old-fashioned horn-rimmed glasses. Said it got him half his promotions—made him look studious.

Studious!

Would they have him waiting there when she got down? There'd been time to get him and Pete halfway around the world—it would be after noon.

Maybe they were both dead.

Minutes filled with such reflections crawled with even greater deliberation. But at last they approached the planet. Ynga waited until the last minute to use her rockets. Then she barely had time to roll *Rival* over and set the proper altitude after she had emptied her tanks. They were coming into the air at a pretty steep angle.

It screamed around them. The impact made *Rival* ring like a bell and shy madly for space. Ynga fought the bird down, drove into the air again. A raging flame built up in front of the ikons along the leading edges. Joel and the other stared in fear and gripped their seats.

After the second impact they saw through a haze. Ynga clamped her jaw hard and bent *Rival*'s nose down steeply. Again and again the bird slammed into the upper atmosphere. Not even Joel's boss became suspicious until it was too late.

Ynga pulled back, leveled off, set the autopilot. She was gasping for breath, tasting blood, and seeing through a haze, head whirling. But she couldn't wait for her head to clear. Reaching over, she gathered up the two pistols, tucked them into the clip under her seat. The small man's helmet was ripped off first. She tapped him a couple of times above the ear to be sure, then brought his hands down and slipped the anti-G strap across between his back and his arms. His arms were free from the elbow down when the anti-G strap inflated, but caught between the arms of his chair where he couldn't switch it off—assuming he knew how.

She fixed Joel the same way. The bigger man was bleeding at the mouth. They could still kick at the control board, but she'd bet her life

continued on page 158

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the greatest asset

The great advantage of being in the frying pan is that it keeps you hopping **by ISAAC ASIMOV**

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The Earth was one large park. It had been tamed utterly.

Lou Tansonia saw it expand under his eyes as he watched somberly from the Lunar Shuttle. His prominent nose split his lean face into inconsiderable halves and each looked sad always—but this time in accurate reflection of his mood.

He had never been away so long—almost a month—and he anticipated a none-too-pleasant acclimation period once Earth's large gravity made its grip fiercely evident.

But that was for later. That was not the sadness of now as he watched Earth grow larger.

As long as the planet was far enough to be a circle of white spirals, glistening in the sun that shone over the ship's shoulders, it had its primeval beauty. When the occasional patches of pastel browns and greens peeped through the clouds, it might still have been the planet it was at any time since three hundred million years before when life had first stretched out of the sea and moved over the dry land to fill the valleys with green.

It was lower, lower, when the ship sank down, that the tameness began to show.

There was no wilderness anywhere. Lou had never seen Earthly wilderness; he had only read of it, or seen it in old films.

The forests stood in rank and file, with each tree carefully ticketed by species and position. The crops grew in their fields in orderly rotation, with intermittent and automated fertilization and weeding. The few domestic animals that still existed were numbered and Lou wryly suspected the blades of grass were as well.

Animals were so rarely seen as to be a sensation when glimpsed. Even the insects had faded and none of the large animals existed anywhere outside the slowly dwindling number of zoos.

The very cats had become few in number, for it was much more patriotic to keep a hamster, if one had to have a pet at all.

Correction! Only Earth's nonhuman animal population had diminished. Its mass of animal life was as great as ever, but most of it, about three-fourths of its total, was one species only—Homo sapiens. And despite everything the Terrestrial Bureau of Ecology could do—or said it could do—that fraction very slowly increased from year to year.

Lou thought of that, as he always did, with a towering sense of loss. The human presence was unobtrusive, to be sure. There was no sign of it from where the Shuttle made its final orbits about the planet; and, Lou knew, there would be no sign of it even when they sank much lower.

The sprawling cities of the chaotic pre-Planetary days were gone. The old highways could be traced from the air by the imprint they still left on the vegetation but they were invisible from close quarters. Individual men themselves rarely troubled the surface, but they were there, un-

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derground. All mankind was, in all its billions, with the factories, the food-processing plants, the energics, the vacu-tunnels.

The tame world lived on Solar energy and was free of strife, and to Lou it was hateful in consequence.

Yet, at the moment he could almost forget, for after months of failure, he was going to see Adrastus, himself. It had meant the pulling of every available string.

Ino Adrastus was the Secretary General of Ecology. It was not an elective office; it was little-known. It was simply the most important post on Earth, for it controlled everything.

Jan Marley said exactly that, as he sat there, with a sleepy look of absent-minded dishevelment that made one think he would have been fat if the human diet were so uncontrolled as to allow of fatness.

He said, "For my money this is the most important post on Earth, and no one seems to know it. I want to write it up."

Adrastus shrugged. His stocky figure, with its shock of hair, once a light brown, and now a brown-flecked gray, his faded blue eyes, nested in darkened surrounding tissues, finely-wrinkled, had been an unobtrusive part of the administrative scene for a generation. He had been Secretary General of Ecology ever since the regional ecological councils had been combined into the Terrestrial Bureau. Those who knew of him at all found it impossible to think of Ecology without him.

He said, "The truth is I hardly ever make a decision truly my own. The directives I sign aren't mine, really. I sign them because it would be psychologically uncomfortable to have computers sign them. But, you know, it's only the computers that can do the work.

"The Bureau ingests an incredible quantity of data each day; data forwarded to it from every part of the globe and dealing not only with human births, deaths, population shifts, production and consumption, but with all the tangible shifts in the plant and animal population as well, to say nothing of the measured state of the major segments of the environment—air, sea and soil. The information is taken apart, absorbed, and assimilated into cross-filed memory indices of staggering complexity, and from that memory comes answers to the questions we ask."

Marley said, with a shrewd sidelong glance, "Answers to *all* questions?"

Adrastus smiled, "We learn not to bother to ask questions that have no answer."

"And the result," said Marley, "is ecological balance."

"Right, but a *special* ecological balance. All through the planet's history, the balance has been maintained, but always at the cost of catastrophe. After temporary imbalance, the balance is restored by

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famine, epidemic, drastic climatic change. We maintain it now without catastrophe by daily shifts and changes, by never allowing imbalance to accumulate dangerously."

Marley said, "There's what you once said—'Man's greatest asset is a balanced ecology.' "

"So they tell me I said."

"It's there on the wall behind you."

"Only the first three words," said Adrastus dryly. There it was on a long Shimmer-plast, the words winking and alive: MAN'S GREATEST ASSET—

"You don't have to complete the statement."

"What else can I tell you?"

"Can I spend some time with you and watch you at your work?"

"You'll watch a glorified clerk."

"I don't think so. Do you have appointments at which I may be present?"

"One appointment today; a young fellow named Tansonia; one of our Moon men. You can sit in."

"Moon men? You mean—"

"Yes, from the Lunar laboratories. Thank heaven for the Moon. Otherwise all their experimentation would take place on Earth, and we have enough trouble containing the ecology as it is."

"You mean like nuclear experiments and radiational pollution."

"I mean many things."

Lou Tansonia's expression was a mixture of barely-suppressed excitement and as barely-suppressed apprehension. "I'm glad to have this chance to see you, Mr. Secretary," he said breathlessly, puffing against Earth's gravity.

"I'm sorry we couldn't make it sooner," said Adrastus, smoothly. "I have excellent reports concerning your work. The other gentleman present is Jan Marley, a science writer, and he need not concern us."

Lou glanced at the writer briefly and nodded, then turned eagerly to Adrastus, "Mr. Secretary—"

"Sit down," said Adrastus.

Lou did so, with the trace of clumsiness to be expected of one acclimating himself to Earth, and with an air, somehow, that to pause long enough to sit was a waste of time. He said, "Mr. Secretary, I am appealing to you personally concerning my Project Application Num—"

"I know it."

"You've read it, sir?"

"No, I haven't, but the computers have. It's been rejected."

"Yes! But I appeal from the computers to you."

Adrastus smiled and shook his head, "That's a difficult appeal for me. I don't know from where I could gather the courage to override the computer."

"But you *must*," said the young man, earnestly. "My field is genetic engineering."

"Yes, I know."

"And genetic engineering," said Lou, running over the interruption,

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"is the handmaiden of medicine and it shouldn't be so. Not entirely, anyway."

"Odd that you think so. You have your medical degree, and you have done impressive work in medical genetics. I have been told that in two years time, your work may lead to the full suppression of diabetes mellitus for good."

"Yes, but I don't care. I don't want to carry that through. Let someone else do it. Curing diabetes is just a detail and it will merely mean that the death rate will go down slightly and produce just a bit more pressure in the direction of population increase. I'm not interested in achieving that."

"You don't value human life?"

"Not infinitely. There are too many people on Earth."

"I know that some think so."

"You're one of them, Mr. Secretary. You have written articles saying so. And it's obvious to any thinking man—to you more than anyone—what it's doing. Overpopulation means discomfort and to reduce the discomfort private choice must disappear. Crowd enough people into a field and the only way they can all sit down is for all to sit down at the same time. Make a mob dense enough and they can move from one point to another quickly only by marching in formation. That is what men are becoming; a blindly marching mob knowing nothing about where it is going or why."

"Tell me, how long have you rehearsed this speech, Mr. Tansonia?"

Lou flushed slightly. "And the other life forms are decreasing in numbers of species and individuals, except for the plants we eat. The ecology gets simpler every year."

"It stays balanced."

"But it loses color and variety and we don't even know how good the balance is. We accept the balance only because it's all we have."

"What would you do?"

"Ask the computer that rejected my proposal. I want to initiate a program for genetic engineering on a wide variety of species from worms to mammals. I want to create new variety out of the dwindling material at hand before it dwindles out altogether."

"For what purpose?"

"To set up artificial ecologies. To set up ecologies based on plants and animals not like anything on Earth."

"What would you gain?"

"I don't know. If I knew exactly what I would gain, there would be no need to do the research. But I know what we ought to gain. We ought to learn more about what makes an ecology tick. So far, we've only taken what nature has handed us and then ruined it and broken it down and made do with the gutted remains. Why not build something up and study that?"

"You mean build it blindly? At random?"

"We don't know enough to do it any other way. Genetic engineering has the random mutation as its basic

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driving force. Applied to medicine, this randomness must be minimized at all costs, since a specific effect is sought. I want to take the random component of genetic engineering and make use of it."

Adrastus frowned for a moment. "And how are you going to set up an ecology that's meaningful? Won't it interact with the ecology that already exists, and possibly unbalance it? That is something we can't afford."

"I don't mean to carry out the experiments on Earth," said Lou. "Of course not."

"On the Moon?"

"Not on the Moon, either. On the asteroids. I've thought of that since my proposal was fed to the computer which spit it out. Maybe this will make a difference. How about small asteroids, hollowed-out; one per ecology? Assign a certain number of asteroids for the purpose. Have them properly engineered; outfit them with energy sources and transducers; seed them with collections of life-forms which might form a closed ecology. See what happens. If it doesn't work, try to figure out why and subtract an item, or, more likely, add an item, or change the proportions. We'll develop a science of applied ecology, or, if you prefer, a science of ecological engineering; a science one step up in complexity and significance beyond genetic engineering."

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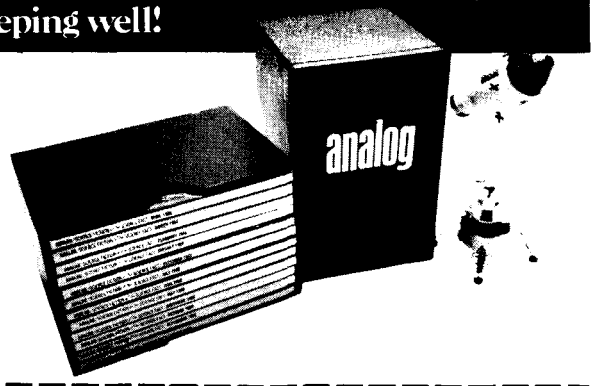

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"But the good of it, you can't say."

"The specific good, of course not. But how can it avoid some good? It will increase knowledge in the very field we need it most." He pointed to the shimmering lettering behind Adrastus. "You said it yourself, 'Man's Greatest Asset is a Balanced Ecology.' I'm offering you a way of doing basic research in experimental ecology; something that has never been done before."

"How many asteroids will you want?"

Lou hesitated. "Ten?" he said with rising inflection. "As a beginning."

"Take five," said Adrastus, drawing the report toward himself and scribbling quickly on its face, cancelled out the computer's decision.

Afterward, Marley said, "Can you sit there and tell me that you're a glorified clerk now? You cancel the computer and hand out five asteroids. Like that."

"Congress will have to give its approval. I'm sure it will."

"Then you think this young man's suggestion is really a good one."

"No, I don't. It won't work. Despite his enthusiasm, the matter is so complicated that it will surely take far more men than can possibly be made available for far more years than that young man will live, to carry it through to any worthwhile point."

"Are you sure?"

"The computer says so. It's why his project was rejected."

"Then why did you cancel the computer's decision?" Jan Marley asked.

"Because I, and the government in general, are here in order to preserve something far more important than the ecology."

Marley leaned forward. "I don't get it."

"Because you misquoted what I said so long ago. Because everyone misquotes it. Because I spoke two sentences and they were telescoped into one and I have never been able to force them apart again. Presumably, the human race is unwilling to accept my remarks as I made them."

"You mean you didn't say 'Man's Greatest Asset is a Balanced Ecology.' "

"Of course not. I said, 'Man's Greatest *Need* is a Balanced Ecology.' "

"But on your Shimmer-plast, you say 'Man's Greatest Asset—' "

"That begins the second sentence, which men refuse to quote, but which I never forget—'Man's Greatest Asset is the Unsettled Mind.' I haven't overruled the computer for the sake of our ecology. We only need that to live. I overruled it to save a valuable mind and keep it at work, an unsettled mind. We need that for man to be man—which is more important than merely to live."

Marley rose. "I suspect, Mr. Secretary, you wanted me here for this interview. It's this thesis you want me to publicize, isn't it?"

"Let's say," said Adrastus, "that I'm seizing the chance to get my remarks correctly quoted." ■

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galactic geopolitics

If the star-thick center of our galaxy abounds with ancient civilizations, are they arrayed in empires, democracies, or . . .?

By Ben Bova

Many people have wondered why we haven't been contacted yet by an alien race. Let's assume, for the moment, that such a contact is inevitable. Sooner or later they will come to visit Earth, or we'll stumble into them somewhere out among the stars.

It seems almost certain that we won't find another intelligent race among the planets of our own solar system. Mars and Venus have been blasted from our hopes by the pitiless advance of knowledge. Mercury, Pluto, and our own Moon were never really counted on as habitats for intelligent races. And the Jovian planets are *too* alien for us—more about that later.

If we find another intelligent race, it will be out among the stars. Assuming that brainy aliens are out there, what are the chances of having any meaningful, fruitful contacts with them? Not just radio chats; not an occasional awe-inducing visit. I mean long-term, continuous interaction, the way we interact with the other nations of Earth: trade, cultural interpenetration, tourism, war, politics.

This all depends, of course, on the realization of interstellar transportation. More than that, it's got to be fast, cheap interstellar transportation. Otherwise there can be no large-scale interactions, no politics, between us and them.

Look at a parallel from Earth's history.

Since at least Roman times, western Europeans knew that China and the Orient existed. In the Middle Ages, Marco Polo got there and back, spreading wondrous tales that grew each year. But Europe did not interact with China in any significant way. True, Europe engaged in trade with the Middle East, and obtained goods from the Orient through Arab middle-men. The Middle East was close enough for Europeans to reach on foot, if they had to. Europe traded with the Middle East, exchanged scholarly works, and engaged in the pious slaughters called the Crusades.

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But there was no direct trade, and no conflict, with China. Once deep-ocean sailing vessels were perfected, though, Europe did indeed contact China directly and treated the Orient to western technology, trade, disease and war. Today, of course, with intercontinental rockets and instant communications, everybody on the globe can interact politically with everybody else.

The same rules could apply to interstellar politics. There may be glorious civilizations in the Orion complex, or even as close as Alpha Centauri. But we know less about them than Hannibal knew about China. No action.

Even today, however, it's possible to visualize a starship based on technology that's within our grasp. Almost. Nuclear fusion engines could provide the thrust for a starship; engineering papers have been published showing how a multi-staged fusion ship could attain a healthy fraction of the speed of light. Cryogenics and biomedical engineering are teaming to produce means of suspending animation, so that travelers need not age during their trip.

With these ideas, it's possible to envision trips to the nearest stars within a human lifetime. When that happens, we'll be in the Marco Polo stage of interstellar contact: adventure, strange tales and artifacts. But no lasting political relations—for better or worse—with the neighbors.

There would be little tourism—except of the scientific variety—when a person can visit the exotic land only once in his life. It's hard to picture trade relations based on one shipment per generation. That's more like a cultural exchange. And even the sternest, most fearless general might feel foolish mounting an attack when he knew that he could never see the outcome in his own lifetime.

But the importance of Marco Polo's adventure was the spur it gave to Prince Henry the Navigator and others, including Columbus. And the importance of the first interstellar contact will be the stimuli it gives to Earth.

Now, if you corner a theoretical physicist in a quiet place and feed him a few drinks, the chances are you can get him mumbling about tachyons and things that go faster than light. Einstein's light barrier is starting to look—well, not leaky, perhaps, but at least a little translucent. Perhaps one day ships will be able to zip among the stars at speeds far greater than light's. Then we can be just as close and chummy with our stellar neighbors as we are today with the Chinese.

But we've got to realize that there will be many races out there that we simply *cannot* interact with in any useful way, even though we may reach them physically.

For example, we may find races very much younger than our own, with a correspondingly simple technology and social development.

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Aside from letting them worship us as gods, there's probably little that they could do for us.

Oh sure, we'd want to study them and learn more about how intelligence and societies evolve. But what could they offer us, aside from their own artifacts and bodies? The artifacts might be interesting as examples of alien art. And no matter how lopsided or gruesome they appear, there will arise at least one art critic who will explain the hidden aesthetic values that everybody else has missed, and sell the stuff at a huge markup.

And their bodies?

We wouldn't use them for meat, for a number of reasons. If their bodies contained some precious chemical substances that couldn't be found elsewhere—like the key to immortality—we'd be in a lovely ethical bind. But the chances for that sort of thing are vanishingly small. We wouldn't need muscular slaves in our technological society; electricity's cheaper. About the only remaining possibility would be the white slave market, and the girls would have to be damned good to be worth the freight charges back to Earth. (There's always the pervert market if the girls aren't lovely, or if they aren't really girls. But that's really a small market.)

And what could we offer our younger neighbors? Only the things that would destroy their culture as surely as western Europe destroyed the American Indians. Hopefully, by the time we reach such a race, we'll have learned to observe them invisibly, from orbit, without letting them know we're present.

If we tried to meddle with a race only slightly younger than we are, their reaction might very well be the same as the Indians'—they'd resist as strongly as they could, possibly with guerrilla warfare. We're finding out in Vietnam exactly what Custer learned nearly a century ago: that "unsophisticated" and "simple" people can use your own technology and weapons against you very effectively. However, the Indians were either killed or absorbed into our culture, and the Vietnamese are going through the same process—that part of the world will never again be a simple, unspoiled, isolated Asian backwater. The same thing would probably happen to a younger race that fights against us: the very act of resisting us will destroy their native culture.

What happens when we contact a race much more advanced than we are? Same situation, only in reverse. We'd have precious little to offer them, except curiosity value. And they'd be wise enough not to tamper with us, I hope. Playing cowboys and Indians is no fun when you're on the foredoomed side.

A really far-advanced race would most likely go its own way aloof and serene, even if we tried our hardest to make friends. The picture that comes to mind is a puppy dog chasing a monorail train.

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That leaves us with races that are more-or-less at our own stage of development, intellectually, morally, and technologically. *That's* where the fun—and the danger—will be.

How much of a range is covered by "more-or-less" is rather hard to say. For a thumbnail definition, let's put it at this: we will interact strongly with races that have something to gain from us, and *vice versa.* Cavemen and angels have so little in common with us that we won't affect each other very much. But other humans, even if they're purple and have sixteen legs, will provide the interstellar action.

Further, the races we interact with will probably come from planets sufficiently like our own to make this Earth attractive to them. And their homeworlds will be similarly attractive—or at least bearable—to us. This is why, even if intelligent Jovians exist, we probably will interact with them about as much as we do with the denizens of the Marianas Trench. There's just no common meeting ground. We don't have political relations with the dolphins, even if they are as intelligent as we are. We've got nothing to trade or fight over.

So it boils down to this: Although we may meet many strange and marvelous races among the stars, if they are physically or intellectually far-removed from us we will have little but the most cursory of contacts with them—except for scientific expeditions. But races that can stand on our Earth with a minimum of encumbrance, and have a technology of a roughly similar level as our own, will be the races that we will talk with, laugh with, trade with, and fight with.

It may be that intelligent life is scattered too thinly through the galaxy to expect to find a race close enough to us—in distance and dispostion—to make interstellar politics likely. There's an oft-used analogy to illustrate the point.

The whole history of the planet Earth, and man, can be illustrated by the Empire State Building. Let the height of the building represent the time since the creation of Earth, roughly five billion years. Man has existed for about a million years; his racial life span can be represented by a three-inch child's block standing atop the building. A dime balanced flat on top of the block stands for the ten thousand years of man's civilization. Pasted on top of the dime, a postage stamp represents the length of time that man's had a reasonably vigorous science and technology.

What are the chances of meeting another race at our own stage of development, within the few centuries represented by the postage stamp? Or even within the ten-thousand-year thickness of the dime?

Remember, below that dime are the cavemen. Much above it, and we're in the realm of highly-ad-

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vanced civilizations that would regard *us* as cavemen.

The chances for meeting neighbors we can truly appreciate seem pretty slim, when you think about that postage stamp. But let's look around anyway, and see what the real world holds for us.

There are thirty-seven known stars within five parsecs of the sun. Twenty-seven of them are single stars, eight are doubles, and two triples. Four of these stars are known to have "dark companions"—bodies of planetary mass that are too faint and small to be seen. In fact, two of the nearest five stars have planets. Since planets are so damnably difficult to detect, you might suspect that there are plenty of them orbiting the farther stars, but we just can't find them from here.

If the population of stars maintains about the same density as we go farther away from the sun, then there should be something like 300,000 stars within 100 parsecs of us; and 300 million stars within 1,000 parsecs. The Milky Way galaxy, as a whole, is estimated to contain some 100 billion stars.

We have no way of knowing how rare intelligence is. But in every cosmological test that's been applied to Earth and the solar system so far, we find utterly no evidence for our own uniqueness. Quite the opposite.

The sun is a rather average star. It appears that planets form around stars naturally. Planets at our temperature range should turn out to look roughly like Earth. Life on those planets should be carbon/water based—that makes use of the most abundant available material and the most energetic chemical reactions they can produce. Given sufficient time, the natural forces that led to the evolution of intelligence on Earth should lead to similar results on similar worlds.

The real question, then, is this: What are the ages of the stars around us? If they are about the same age as the sun, we might reasonably expect to find interesting neighbors.

The sun's age has been pegged at roughly five billion years. This is based chiefly on estimates of how much of the sun's original hydrogen fuel has been converted to helium in the thermonuclear fusion process that makes the sun shine.

Many of the stars around the sun are clearly much younger. Table 1 shows the spectral classes of typical stars, together with estimates of their stable life spans. By "stable life span" we mean the length of time that the star is on the Main Sequence. Stars go through an evolutionary path.

1. A protostar condenses out of clouds of interstellar gas and dust. The protostar, a dark clump of mostly hydrogen, is about a light-year wide. It contracts rather rapidly, falling inward on itself under the gravitational force of its own mass. As it contracts, density and temperature at the core rise steeply.

2. When the density and tempera-

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Table 1: SPECTRAL CLASSES AND LIFE SPANS OF STARS

Spectral Class	*Surface Temperature*	*Color*	*Stable Life span*	*Example*
B	11,000-25,000°K	blue	8 to 400 million years	Rigel, Spica
A	7500-11,000	blue-white	400 million to 4 billion	Sirius, Vega
F	6000-7500	white	4 to 10 billion	Canopus, Procyon
G	5000-6000	yellow	10 to 30 billion	Sun, Capella, Alpha Centauri A
K	3500-5000	orange	30 to 70 billion	Arcturus, Aldebaran, Alpha Centauri B
M*	below 3500	red	more than 70 billion	Alpha Centauri C, Barnard's Star

**Note: Red Supergiants such as Betelgeuse and Antares are not on the Main Sequence, hence their stable life spans in no way correspond with those of the red M dwarfs shown on this Table.*

ture at the core reach high enough values for hydrogen fusion to begin, the star becomes a stable member of the Main Sequence. Its size and surface temperature remain stable as long as hydrogen fusion provides the star's energy source.

3. The bigger and more massive the star is, the hotter it is, and the faster it runs through its hydrogen fuel supply. When the hydrogen runs low, the star begins burning the helium "ash" that's left in its core. Helium fusion runs hotter than hydrogen fusion. The star's core temperature soars, and the outer layers of the star are forced to expand. The star leaves the Main Sequence and becomes a Red Giant. Helium fusion creates carbon, oxygen and neon. When the helium runs low, the star turns to burning these heavier elements. The star continues to create and then burn constantly-heavier elements; all the while its core is getting hotter, and its outer envelope is swelling enormously.

4. Eventually the star reaches a critical point. It explodes, either with the relative mildness of a nova, or with the star-shattering fury of a supernova. The eventual result is a

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white dwarf star or, in some cases, an even smaller, denser neutron star—or pulsar.

As you can see, the star remains stable only for a certain period of time, depending on its mass and surface temperature. After that, things get pretty dramatic for any planet-dwelling life nearby.

Hot blue giants such as Rigel and Spica won't be stable for more than 400 million years; the life span of a stellar gnat, despite their brilliance—or, really, because of it. By extrapolating backwards, moreover, we can see that these stars can't possibly be more than 400 million years old. Probably they're a good deal younger. Perhaps the dinosaurs never saw Rigel.

We know that it took about five billion years for intelligent life to develop on Earth. As a rule of thumb—lacking any better information—we can say that we shouldn't expect to find intelligent life on planetary systems of stars less than five billion years old. Thus, stars such as Rigel, Spica, and probably even Sirius and Vega, might be ruled out as possible abodes for intelligent life.

The stars that are smaller and cooler than the sun, such as the K and M dwarfs, have enormously longer life expectancies. But are they older than the sun? There's no easy way to tell.

We might be able to get some clues to their age by looking further afield. Consider the "geography" of the Milky Way galaxy.

The Milky Way is, of course, a spiral galaxy much like the beautiful spiral in Andromeda. The core of our galaxy is presumably thick with stars, but we never see them because they're hidden behind dust clouds. However, by looking at other spirals, and comparing their structure to the optical and radio-telescope evidence we have about the Milky Way, astronomers have made a reasonable picture of how our galaxy is built.

The core of our galaxy is rich with stars. These stars are predominantly much older than the sun; red giants are common. There is very little interstellar dust in the galaxy's central region, if any.

Out in the spiral arms, where we are, there is much dust. As we've already seen, this dust is the budding-ground for new stars. And, indeed, we see blazing young giants such as Rigel and Achernar and Spica only in the spiral arms.

Because the two regions of the galaxy seem to have different stellar constituencies, astronomers refer to the types of stars found in the spiral arms as Population I and those found in the core as Population II. Population I stars are young, the brightest members tend to be blue giants and supergiants, and they have a relatively high proportion of

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heavy elements in their make-up. Although the amount of heavy elements in them is never more than one per cent, the Population I stars are said to be metal-rich. Population II stars are old, the brightest members are red giants, and they are mostly metal-poor.

The metal content of a star is an important clue to its age. But before we go into that, we should note that cosmologists have estimated the Milky Way galaxy to be between 10 and 20 billions years old. That is, from two to four times the age of the sun. The universe, as a whole, is presumed to be of approximately the same age as our galaxy.

Now then, why are the stars in the galaxy's core metal-poor and the stars in the spiral arms metal-rich? Because the elements heavier than hydrogen have been created inside the stars. It works like this:

Consider the Milky Way before there were any stars. An immense dark cloud of gas, at least 30,000 parsecs across. The gas might have been entirely hydrogen, or it might have been a hydrogen/helium mixture. The Steady State cosmology leans toward all-hydrogen; the Big Bang would produce maybe 10 per cent helium.

The first stars to form, then, had no heavier elements. From lithium to iron, the heavier elements were cooked inside these stars as they went from hydrogen-burning to helium-burning to heavier-element-burning. Some of these stars went supernova. In those titanic explosions, even heavier elements were created, beyond iron, all the way up to uranium and even beyond. There's some evidence that the so-called "man-made" element, Californium 254, was present in the supernova of 1054, which we know today as the Crab Nebula.

So the first generation of stars in the Milky Way began with only hydrogen—and maybe some helium. But they produced heavier elements and spewed them back into space to form part of the building material for the next generation of stars.

Most astrophysicists believe that the sun is at least a third-generation star. Beware of a clash of jargon here. Population I stars are late-generation, younger stars. Population II stars are older, early generation. II came before I, historically.

What's all this got to do with meeting the neighbors?

Just this: The first-generation stars *could not produce life.* At least, nothing we'd readily recognize as life. There was no carbon, no oxygen, nothing but hydrogen and perhaps helium. If those first stars had planets, they'd all be gas giants like Jupiter and Saturn, only more so; there'd be no methane or ammonia or any other heavier element or compound.

Second-generation stars? It's possible that they'd have most of the heavier elements, including the carbon, oxygen, nitrogen, potassium, iron and such that we need for

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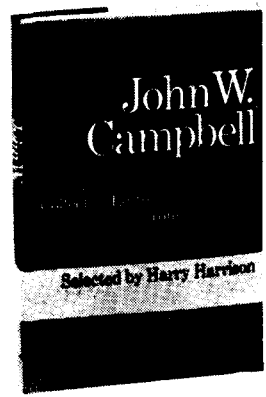

biochemistry. Planets of such stars might be able to support life—even our own kind of life—if these heavier elements are present in sufficient quantities. And if life has appeared on such planets, there's no reason to suppose it wouldn't eventually attain intelligence. Certainly the long-lived red dwarfs provide plenty of time for intelligence to develop: five billion years plus.

Let's grant that an intelligent race could arise on a second-generation star's planetary system. Could such a race develop a high civilization and technology? It all depends on the abundance of natural resources. Fossil fuels should be plentiful. But what about metals? Our technology is built around metals. Even our history rings with the sounds of the Brass Age, the Iron Age, the Steel Age, the Uranium Age.

The astronomical evidence is indistinct here. Astrophysical theory shows that second-generation stars should have a lesser abundance of heavy metals than we third-generation types do. But certainly there should be some metals, spewed out by first-generation stars.

In fact, if the first-generation stars included the same ratio of very-short-lived supergiants that we see in the heavens today, and these supergiants ended their brief (10 million years) lives in heavy-metal-producing supernova explosions—then there could be some favored second-generation stars that have a high per-

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centage of metals in their make-ups. But on the whole, it would seem that the chances of finding a metal-rich second-generation star are rather poor. Certainly astronomical observation shows that these older stars tend to be metal-poor.

But how much metal is enough? There's no way to tell. Planets of second-generation stars might have iron mountains and gold nuggets lying on the open ground. Or they might have very little available heavy metals. Availability is the key, of course. Our own Jupiter might easily have more iron in it than Earth does. But if it's there, it's mixed in with 317.4 Earth masses of hydrogen, helium, methane, ammonia, and whatnot. Try to find it! And use it!

If there are planets of second-generation stars where heavy metals—iron, copper, silver, tin, gold—are abundant and available, those planets could be sites for highly advanced civilizations. But suppose intelligent races arise on planets where heavy metals are not available? What then?

First, we should clearly realize that intelligence *per se* doesn't depend on heavy metals. Mankind rose to intelligence with only wood, clay, rock and animal products as his natural resources. In a way, man went through a Ceramics Age—clay, mostly—before he discovered metals. In fact, it was wood and ceramics that allowed man to handle fire safely and usefully. Only after fire had been tamed did metals become possible and useful.

The history of man's technology shows that once metals became available, the race took a giant leap forward. And our own history is the only evidence we have to go on. Metals allowed men to build effective plows. And swords. And chariots. Even today our skyscrapers and computers and engines and spacecraft and weapons and refrigerators are made of metals. Metals are strong, tough, and cheap. And they are easily found and easily worked, with low-grade fire.

Could a race build skyscrapers and spacecraft without metals? Well, today there are many "space age" materials such as plastics and boron- or carbon-fiber composites. But take a look at the machinery that produces them: stainless steel, copper, brass. Modern technology is showing that there are nonmetallic materials that can outperform metals in strength, weight, and many other parameters. But these materials could not have been developed before an extensive Metal Age of technology. Cavemen, or even the ancient Greeks, could not have produced boron-fiber materials or modern plastics or ceramics—because they didn't have the metals to produce them with!

Would a race on a metal-poor, second-generation planet be stymied in its attempts at technology? Who can say? All we know for sure is that *our* technology depends on metals,

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and until metals were available, we had no civilization or technology beyond that of the Neolithic.

And another vital point. Again, we have nothing but the history of our own race to go on, but it looks very sure that without metals such as iron and copper, we would never have discovered the world of electromagnetic forces.

Man's discovery of magnetism depended on the abundance of iron on this planet. And from the beginning, man's experiments with electricity have needed lead, zinc, copper, et cetera. It's hard to see how the whole chain of study and use—from Volta and Faraday and Hertz on through to radio telescopes and television and superconducting magnets—could have happened in a metal-poor environment. And where would our technology be without electromagnetics? Early Nineteenth Century, at best. (Unless psionics had been legitimized, found to work, and filled the gap.)

So where does that leave our metal-poor, second generation races? It just might be possible to build a complex technology completely out of nonmetals; but tribes on Earth that never had easy access to heavy metals have never developed a high technology. Coincidence? Maybe. Could a strong technology be built around the lighter metals, such as lithium, beryllium or boron? Ironically—pardon the pun—these metals are much less abundant in the universe than the heavier—iron and up—metals. And for good reason: they make excellent "fuel" for the nuclear fusion reactions that power the stars. So the chances of having a sophisticated civilization based on light metals seem slim indeed. If our own history is any criterion, it's the heavy metals that lead to high technology. And they form a natural gateway to the world of electromagnetic forces and the whole concept of "invisible" forces that act over a distance: magnetism, electricity, gravity, nuclear forces. You can trace a direct line from man's use of heavy metals to electromagnetics, nuclear power, and—eventually, I hope—antigravity.

It looks, then, as if the oldest stars in the Milky Way, those first-generation members that are still around at the galaxy's core, have always been lifeless.

For the second-generation stars the situation is much cloudier: either they have enough metals to develop high civilizations or they don't. If they do, their races are so much older—and hopefully wiser—than we are that they won't interact with us at all. We'd probably bore them to whatever they have for tears. If they don't have metals, then they're probably gamboling innocently through some local version of Eden, and we should leave them strictly alone.

There goes the long-standing vision of an immense galactic empire, run by the older and wiser races of the Milky Way's ancient core. Like

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the steaming jungles of Venus and the bone-chess cities of Mars, the empire at the center of the galaxy doesn't exist. Either the older races are *so* far advanced that empires are meaningless trivialities to them, or they're so metal-starved that they never got past the "Me Tarzan" stage of development.

Remember, the first empires on Earth, in the Tigris-Euphrates plain, didn't get started until the local heroes had bronze swords, metal-shod horses and chariot wheels and gold helmets—at least, for the captains of the winning team.

It's a shame. It would have been pleasant to talk to them—those incredibly ancient, benign, understanding super-beings from the galaxy's core. It's sort of shattering to realize that, if they exist, they wouldn't want to be bothered with our chatterings any more than a crotchety grandfather wants to put up with a squalling baby.

On the other hand, we've all seen plenty of stories in which a race only slightly advanced over us—say a few centuries, technology-wise—does a very ruthless job on Earth and its people. So maybe we should be glad if there's no one older who's interested in us.

Now then, where do we stand?

There may be older, second-generation races out there, but they just *don't care* about us. As far as they're concerned, we're on our own. There may be third-generation races closer to us, both geographically and intellectually. If they're ahead of us by even as much as a mere century or two, they could be decidedly dangerous. Imagine the job we could do with today's technology against Napoleon!

Of course, an older race might be benign. If so, it would probably not reveal its presence to us, for fear of damaging irreparably our pscyhes and culture, until we were ready to meet them on a more equal footing. The "equality" point might come when we've achieved an interstellar drive for ourselves.

If an older race is not benign, but aggressive, it would probably want to gobble us up before we had reached the interstellar flight stage. That way, we'd be more or less alone and defenseless against them. So, if we get visited by aliens from another star *before* we go star-roving ourselves, my hunch would be that their intentions might be far from pleasant—no matter what they say!

But the chances of meeting another race that's even within a few centuries of our present stage of development seem extremely remote. And remember, the sun is one of the oldest third-generation stars around this part of the galaxy. There might not be any older races within many kiloparsecs of us.

Could it be that *we* are the oldest, wisest, farthest advanced race in this neck of the stellar woods?

Now that's a truly sobering thought! ■

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KELLY FREAS

a spaceship for the king

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Part Two.
They'd come light-years,
but how do you get
across a continent of pirates
and barbarians
when you can't use weapons
the enemy hasn't got and
you're outnumbered
ten thousand to one?

JERRY POURNELLE

SYNOPSIS

Prince Samual's World was devastated by The Secession War which broke up humanity's First Empire. It slowly has developed technology roughly equivalent to the early Nineteenth Century but retains traditions of lost scientific achievements. Redevelopment has been slow because the North Continent is broken up into dozens of independent city-states, with a few larger kingdoms which constantly war on each other and the smaller states to unite the planet under a single ruler. The South Continent and Archipelago are even more primitive, ruled by barbarian despots.

COLONEL NATHAN MACKINNIE, called Iron MacKinnie by his soldiers, has been cashiered from his post as acknowledged best soldier of the Republic of Orleans. Iron MacKinnie and his Wolves repeatedly defeated the forces of the Republic's powerful neighbor, the Kingdom of Haven, until Prince Samual's World was rediscovered by a survey ship of the renascent Second Empire. Now the Imperial Navy has allied with King David of Haven, and by using space weapons destroyed much of MacKinnie's army. Orleans has been forcibly incorporated into Haven as a Duchy, and its officers turned out on pension.

MacKinnie and his former sergeant, HAL STARK, overhear a drunken young Imperial Navy officer telling about a primitive planet called MAKASSAR where "they wear iron

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pants and fight with swords," have no machinery except a First Empire Library which they use as a Temple, not suspecting what the building really is. After leaving the bar, MacKinnie and Stark are taken to the offices of MALCOLM DOUGAL, the Chief of Haven Secret Police, who has been following the Imperial Navy officers and has also overheard the conversation about the Library. Dougal questions MacKinnie closely, tells him he has a use for the ablest of Haven's former enemies if they will agree to serve King David. MacKinnie also learns that Dougal has an almost pathological hatred of outworld things even though the Navy is allied with Dougal's king.

After swearing MacKinnie to secrecy Dougal shows him a novel discarded by an Imperial sailor. Although details about the Imperial government have never been given to Haven, Dougal has deduced that the Empire has several classes of membership based on technological status at the time of incorporation. Only planets having space travel have any real rights; the others become colonies subject to the absolute rule of the Imperial government on Sparta.

Dougal has also learned that the Imperial Navy is fanatically determined to bring all of humanity under Imperial rule to prevent wars like the Secession War which broke up the First Empire. Naval cadets are sent to New Annapolis on Terra to see firsthand the destructiveness of war. The present emperor had been a midshipman himself. The policy of the powerful Second Empire is to unite mankind without much regard for abstractions like freedom and independence.

Because the Navy is spread too thin to immediately incorporate newly discovered planets like Samual and Makassar, the Empire allows no new technology imports. Thus, although Haven as an Imperial ally has theoretical rights to interstellar travel and trade, the Haven traders may not visit planets with more advanced technology or buy from them.

However, Makassar is classed as a primitive world and is on the approved list for trade with Samual. Dougal believes the Imperial bureaucracy has forgotten the Library since the natives cannot use it and it is guarded by a priesthood who believe that God will someday speak to them from the Temple.

Dougal needs a military officer, but the Imperial Navy would know Haven's best soldiers. Dougal's plan is an expedition to Makassar, ostensibly for trade, but actually to bring back knowledge of space technology from the Temple Library. Haven will use this to construct a spaceship so that King David can bring Prince Samual's World into the Empire in one of the higher classifications, thus escaping colonization.

MacKinnie agrees to head the project because he has felt useless since his dismissal from the army, but has little confidence in the mission. He is to pose as a Trader Magnate, while

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Dougal spreads the rumor that Iron MacKinnie has died of war wounds and alcoholism. Unknown to MacKinnie, Dougal has everyone, who knows MacKinnie is alive, kidnaped or murdered. When MacKinnie discovers this and objects, Dougal says they can erect statues to these people after the mission succeeds.

MacKinnie and Stark recruit several former Wolves as Trader's guards, and Dougal supplies other expedition personnel. These include: JAMIE McLEAN, a Haven naval officer posing as a merchant captain; Academician HAROLD LONGWAY, a social scientist with experience among primitives on South Continent; Scholar HOMER KLEINST, a brilliant nineteen-year old physics student who poses as Longway's social studies assistant; and Freelady MARY GRAHAM, daughter of an officer of Haven Secret Police, who will be expedition secretary. Dougal also furnishes some guards, one of whom, TODD, MacKinnie believes to be a Haven officer cadet assigned to keep watch on him.

The trading details of the expedition are efficiently organized by Mary Graham while MacKinnie and Stark design armor and medieval period weapons they hope will be useful; they know little about Makassar except that large parts are overrun with nomadic barbarians.

In conference with the Imperial Traders' Association including Trader RENALDI who will accompany the expedition, MacKinnie finds that the Traders and the Navy hate each other. The Navy will enforce all regulations, and introducing new technology to Makassar will bring MacKinnie life imprisonment. He also learns that there are only a handful of Imperial officers on Makassar, and the Navy can offer no protection to the expedition.

After the conference with the Traders and Navy officers, MacKinnie tells Dougal "I still don't know any more about those books—only they aren't books, are they? That Navy kid in the bar babbled about spools, whatever that might be. Maybe they could be made to print books if we knew how to do it. Well, the sooner we start, the better chance we'll have. It's still a fool's errand, but by God at least I can feel useful again, win or lose!"

Part 2

VII

Under MacKinnie's repeated urgings, the cargo was loaded in two days. Renaldi, anxious to depart so that he could, as he said, return to a civilized part of the galaxy, aided MacKinnie and his crew through the complexities of the Navy inspection. Nathan was surprised to discover the Navy paid little attention to him or his crew, but did inspect all the cargo to be shipped to Makassar. Young Landry was competent enough, but the civilian clerks assisting him had little concern for the affairs of the primitives. It was obvious to them

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that neither Makassar, nor Prince Samual's World, was any threat to the Empire, and in particular none to their files. So long as the proper forms were properly filled out, the rest did not matter.

Three days after MacKinnie's first meeting with the Imperial Traders, they blasted off from Prince Samual's world, rising on a jet of steam in the squat cylindrical merchant landing boat. The merchant craft was ugly, nothing like the slim Navy landing ships which floated near Imperial Dock, but it was serviceable, not built for atmospheric maneuvering, simply lifting weight.

There was a moment of terror when the jets cut and they were in orbit. The Samualites had not been warned about free fall, and thought they were falling, falling endlessly. MacKinnie grimly faced death, reviewing the silly prayers the chaplains said over the dying. Somehow they did not seem silly at all. But then Landry told them all was well, responding to Marv Graham's near hysterical questions.

"We are in orbit," the midshipman said. "The sensation of falling is caused by . . . oh, the devil with it. The main thing you need to know is that we can't fall. Without power, we'd never leave this orbit, just go sailing around forever like your moons."

The incident served to reassure MacKinnie about Kleinst. The young scholar had evidently known they were safe, but made no move to assure the others and thus break his cover as social historian. MacKinnie did not care for weaklings, but the young man seemed to have common sense as well as educated intelligence.

It took hours before they matched orbits with the merchant starship and were shown to staterooms, floating gently through the connecting passageways between the landing craft and the main ship, gingerly following the tow lines the ship's officers had strung for them. Their staterooms proved to be minuscule cubicles, sparsely furnished at first sight, but when buttons were touched, various utilities such as beds and tables unfolded from the walls. Except for these, however, the Samualites were not permitted to examine any of the marvels of Imperial technology. Landry had explained that the landing jet worked by steam heated in something he would not explain, but this did not seem particularly helpful. MacKinnie was strapped into a chair, and slowly weight returned to him.

A ship's officer led him into the lounge, where the others were already assembled. The room was completely alien to MacKinnie. It was splendidly furnished, but in addition to couches, chairs and tables on the deck beneath him, one large circular wall was also covered with carpeting and furniture, all bolted into place. The wall was not a complete disk, for a large central tube ran through it well over Nathan's

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head. Stranger than the double furniture, was the deck, which curved *up* both in front of him and behind him, yet, when he walked around it, it always felt as if it were *down*. After a few strides, he looked back to see that where he had been was now well above him. A few more steps brought him around the central column "overhead" to reveal Renaldi apparently hanging from the ceiling, relaxing in a large chair, a drink in his hand.

"Ah, Trader MacKinnie, please be seated. The others will be here shortly." Renaldi sipped his drink. "Pleasant to have weight again, is it not?"

"Yes." MacKinnie sat, again noting the eerie sensations in his inner ears whenever he made a sudden movement. "How have you accomplished this, uh, giving us weight?"

Renaldi looked startled for a moment, then smiled. "You truly don't know, do you? I'll wait until the others arrive and explain. Have a drink, Trader. We can only enjoy this for another hour before the captain gets under way, and we will all have to be in our staterooms for the transition."

McLean, Longway, Kleinst, and Mary Graham joined them within moments. Midshipman Landry was a few minutes late, and explained that the guards and their leader were quartered on another deck with a lounge of their own. When all were seated, Renaldi told Landry, "The Trader is curious about our weight, Midshipman. Surely the Empire will not fall if we explain to our guests?"

"No, of course not, Trader," Landry said. "You see, gentlemen and freelady, the captain has caused the ship to rotate about its long axis. Thus you are thrown towards the outside of the ship. When we begin our voyage, however, the ship will accelerate for long periods of time, and the rotation will cease. While we accelerate, you will feel weight, but 'down' will be that deck in front of you, and this deck will become a wall." The boy paused for a moment, then said suddenly, "If you have never been off-world, you have never seen your own planet. There are ports at that bulkhead there, allow me to open them for you."

Before any of the others could rise, Kleinst had charged across the deck, eagerly waiting until the port was uncovered. With a shrug, Landry uncovered several more, and the others took turns looking out. No one had the heart to remove Kleinst from his post.

They saw Prince Samual's World, although it did not appear to them as a sphere as the orbit was not that high. Partly obscured by the clouds, they could nevertheless see much of the great mass of North Continent, a portion of the Major Sea, and several of the larger islands of the Archipelago. Except for masses of fleecy clouds, it looked exactly as globes and maps they had studied in school. The world below them appeared to be moving across their

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field of vision, however, and after it passed, they would see the black of space, stars shining more brightly than they had ever believed possible.

For long moments there was no conversation. Finally, slowly, they one by one filed back to their seats, except for Kleinst, who stayed at the port until they were ushered to their staterooms for the beginning of the voyage.

MacKinnie was not allowed off the lounge deck except to go down a ladder to the deck below where Stark and the guards were quartered. His troops had far less luxurious quarters than his own, but somewhat more open space, and Hal was using the time to best advantage, training the men in unarmed combat, and experimenting with swords and shields from their personal baggage. The men seemed cheerful enough, and MacKinnie ordered a small daily ration of brandy for each man to relieve the monotony. He returned to his own quarters for the same prescription.

The days flowed by with a monotonous quality, relieved by their constant efforts to master the language of Makassar. MacKinnie and McLean sent for wooden swords and put in an hour of practice daily, resulting both in bruises on their persons, and considerable respect for each other. They also trained with their men.

Longway and Mary Graham seemed to have a knack for languages; particularly the Academician who passed from the main dialects to lesser ones he found in supplementary sections of the loose-leafed books the Imperial Navy had supplied. They were informed that the books would be collected before they made planetfall, and MacKinnie held his breath at the mention, but nothing else was said about them.

Eleven days out from Samual, they were again strapped into their chairs in their staterooms, experiencing another hour of weightlessness before normal weight returned. By constant pestering of Landry whenever the boy joined them, McLean induced him to tell them that during the first part of the journey they had accelerated, and were now decelerating in order to enter faster than light travel. When he received only quizzical looks from the others, Landry explained further.

"There're two kinds of drive, normal space and hyperspace. In normal space, the fusion drive works into a Langston field releasing photons which propel the ship. Never mind, I'm not allowed to explain it to you anyway. But this pushes the ship right along, and we experience acceleration from it. The hyperspace drive works on a different principle. It only works along the pseudo nuclear force path between two stars. I don't suppose that means anything to you. There are force paths between the stars similar to the forces

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that hold atomic particles together. They fade off rapidly in an exponential relation to distance—oh, Hell, that doesn't tell you anything either. What's important is that the drive won't work if you're near a sun or a planetary body. You have to get a long way out from the primary to get into hyperspace, and it kicks you out when you get close to anything. So once we get decelerated to a speed not too great relative to the sun we're leaving, we can get into the hyperspace path between stars. In there we can go faster than light."

Landry glanced about him, and Kleinst quickly assumed the blank stare typical of the others. The midshipman scratched his head, muttered that that was all he was allowed to say anyway, and asked for another drink. MacKinnie noted that the boy usually would have exactly three drinks, and would always leave their company as soon as he had consumed the third one. He also noticed that the midshipman seemed to be a great deal more talkative when Mary Graham was present, and decided she might be useful after all.

Days were measured by the ship's clocks, which were geared to a standard day somewhat shorter than that of Prince Samual's World, as Samual's years were slightly shorter than those of Earth. MacKinnie noted that the Imperials tended to use many expressions and physical devices traditional from Earth, and once Landry told Mary Graham that this was because the Old Empire had been directly based from the mother world. His Majesty was determined that the new Empire would be as great as the Old, but more permanent.

On the twenty-second day, they were once again warned to go to their cabins, and later each was personally inspected by Landry. "Don't panic, no matter what you think you see or hear," he warned each. "Hyperspace transition affects different people different ways. Just be calm and everything'll be all right."

An hour after the boy left them, MacKinnie was in a cold sweat, waiting with nothing to do. He hoped that the others would remember their instructions. As he inspected his mechanical watch for the twentieth time, there was a strong thrumming sound which seemed to permeate the ship. This went on for several minutes, then there was an imperceptible lurch, as if intolerable acceleration had been applied for a time so short that it had no chance to affect them.

At once, Nathan was aware of a sensation of intolerable *wrongness*. He looked at the walls and other now-familiar objects, and they seemed the same in every detail, yet somehow different. Strange sensations crawled across his scalp. The thrumming sound was gone, but something of it lingered, and it did not sound like anything he had ever heard before.

Then there was a moment of si-

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lence. It was too brief to be completely perceived, but it seemed to be a silence which had a tangible quality, a deadening effect that sucked up sound, and perhaps heat and light and everything else. Then there was the sound again, which rose and died away, and after that weight returned, oriented toward the circular section which MacKinnie had come to think of as the walls of his cabin. With weight, his universe returned almost to normal, although, somewhere inside his brain, there was a tiny terrified awareness that everything was *wrong*.

The transition out of hyperspace was not as severe a wrench as the entrance, and as soon as it was over the feeling of wrongness was gone. "Down" became the main deck again, and with the Coriolis distortions gone it was no longer important to be careful not suddenly to change the height of the upper body with respect to the outer skin of the ship. MacKinnie noted that his crew seemed more relaxed, and redoubled the training with Makassar weapons.

The journey from their point of entry into normal space to Makassar took another twenty-four days, with the transition from acceleration to deceleration taking place in the middle of the night. They were gathered in the main lounge, with Stark acting as a serving man, on the "afternoon" of the last day when the hatch opened and they were joined by Landry and Renaldi.

"We have nearly arrived, gentlemen," Renaldi announced importantly. "I have requested Midshipman Landry to allow you to see the object of all your attention, and he has graciously consented. It will be visible through the ports over there." As Renaldi spoke, Landry removed the locks from the observation ports and opened them.

Makassar was a tiny ball, hanging in the dark of space. The most prominent feature, easily visible even from their distance, was a pair of enormous ice caps. Much of the world between them was water, with a single continent, mostly in the Southern Hemisphere, swimming westward like an enormous whale. Two large islands, almost continental in size, hung above it in the Northern Hemisphere, and the shallow seas were dotted with smaller islands. There were two distinct colors to the seas where the sun shone upon them, and Kleinst remarked that it must be due to a dramatic difference in depth. Deep water was mostly in the Northern Hemisphere, with the continent surrounded by the pale blue marking much shallower depths.

"It's a lovely world," Landry remarked, standing next to MacKinnie and pointing out some of the more visible features. "Smaller than Earth. Gravity is about .87 that of Earth, which makes it about, oh, let's see." He withdrew his small computer and wrote directly on one face of it with an attached stylus. "I make it .79 the gravity you're used to, Trader. You

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men are going to be very strong compared to the locals down there. That might be useful."

"It might indeed," MacKinnie muttered. "Are those ice caps normal in size? I seem to recall our maps of Samual show much smaller ones."

"Makassar is a bit colder than Samual. Orbit's more eccentric, enough to make some climatic differences. The inclination of the planet is also greater. Turns out it's summer—by planet inclination—in the Southern Hemisphere when the planet's farthest from the sun. I don't know, but I wouldn't be surprised if the two big islands in the north were uninhabitable, or nearly so. It would be pretty cold there. You're arriving in the middle of spring on the continent."

MacKinnie recalled the maps they had been given. Except for a few sea trader towns, the entire population of Makassar was concentrated on the main continent, at least as far as the Imperials knew. The maps weren't very accurate, but at that they'd be the best obtainable.

They watched the planet grow larger and larger as the ship approached. Each member of the expedition stood in silence, lost in his particular fantasy, dreaming of other worlds. Then the alarm sounded, and they scrambled for the landing boat.

The Imperial base was located in a small trading town on a great bay at the western end of the planet's single continent. A scattered chain of islands led across the shallow seas to a series of large islands from which trading ships and sometimes pirate raiders came. Because of their depredations, the area around Jikar was largely uninhabited, which suited the Imperials well. Their presence in the town was disturbance enough; they had no desire to be seen by any large number of the people of Makassar.

Navy House was crude, a stone building constructed by the locals, and there was no Marine Barracks. Whatever defense the Imperials had installed was not obvious to MacKinnie as his little group approached. Behind them, the landing craft lay in the water, guarded by its crew and a group of hired locals.

Many of the locals were small men, brown and dark, reminding MacKinnie of the two officers aboard the trading starship. Their clothing was crude, some of the men wearing trousers, others dressed in long gownlike robes which hung to their knees. In sharp contrast to the passengers of the starship, everyone seemed to have a beard of some kind, although many of them were not well developed. Their hair was long, and it was obvious at a distance that they did not often practice bathing.

In the hundred meters from the docks to Navy House MacKinnie's party was approached by at least ten beggars, some of them proudly displaying truly horrible disfigurations.

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They shouted and pleaded, and MacKinnie was pleased to see that he was able to understand them reasonably well. The practice aboard the ship had been useful for learning the language, even if he did not care much for his first encounter with it. Stark tossed out a few copper coins, allowing them to escape as the beggars cursed and fought for the money.

They were permitted to stay in Navy House for a few days only, and MacKinnie's officers eagerly explored the small town, talking to the inhabitants and investigating the possible marketable goods for sale. At the end of the third day on the planet, they assembled in the one large room of the headquarters building. Renaldi, as usual, sat by the fire, a glass in his hand.

"Your Excellency, we have been unable to find a single thing worth transportation to Prince Samual's World. We are beginning to think there is nothing here," MacKinnie began. "Where are the spices, and exotic cloth, and the rest that you and your partner described?"

Renaldi laughed. "For all I know," he said thickly, "there may not be another valuable thing on the planet. Soliman cleans a place out pretty good when he gets the chance."

"But, but," stammered MacKinnie, "if there's nothing here, we're ruined. You've charged us an enormous price for transportation to this place. Surely there's something worth buying. How are we going to recover our expenses?"

"You probably won't. We never promised you a profit, Trader." Renaldi pronounced the title as if it were an insult. "In our business, you have to take chances. Perhaps you took an unwise chance."

"But we took it on your advice!" MacKinnie snapped, then changed to a pleading tone. "Surely you know of some way we can make this profitable for King David. Surely with your experience you can help us."

"Unlikely." Renaldi drank deeply. "But whatever it is you are to do, be quick about it. The ship leaves in three days."

"Three days! Why that's impossible. You promised us sufficient time to arrange for trade, even to organize a permanent company here. We can't begin to arrange for trade in three days. You knew that before we started." MacKinnie looked down at the impassive face and had an urge to tear out the small moustache by the roots. He restrained himself and said, "I'm going to complain to the Navy. They'll make you honor your contract."

"Our contract, Trader, says that you will be brought here, and returned at a time mutually convenient. The ship leaves in three days. That's convenient to us. And you've nothing to complain about, we're going to two other star systems before we go back to your miserable planet. You won't be permitted out of your quarters while we're there,

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but think of the broadening travel you'll get."

"It is not mutually convenient if one party does not agree," Longway said softly. "We may have few rights, Imperial Trader Renaldi, but I suspect Captain Greenaugh will enforce those we have. He did not seem to be overly fond of Imperial Traders, Your Excellency. We will not leave in three days."

Renaldi shrugged. "Suit yourselves. The next ship we could schedule through this miserable system will arrive at this port in something over a standard year. If you wish to wait for it, I will have the Navy compute the exact number of local days before it arrives. You can wander this poverty-stricken ball until you tire of it." He filled his glass from an open bottle on the great table which dominated the room. MacKinnie noted that the bottle was handblown, and crudely at that, but of an interesting color. Renaldi seemed to be fond of the local liquor.

"Three days, or over a year," Nathan observed. "Neither is very convenient."

"Those are the times convenient to us. Which do you choose?" Renaldi backed away from MacKinnie nervously as the soldier approached him, fingering his belt as if grasping for a weapon which was not there. He managed to get back to his seat, where he regained his composure. "Come, now, we never promised you more. And think of the adventures you can have, wandering about on a planet of swineherds." He laughed for a moment, saw MacKinnie's face, and stopped short.

Nathan turned to McLean and said, "Go get the lieutenant in command of this post. We may as well find out just what else this man can do to us." The group waited in a strained silence for several minutes before McLean returned with Midshipman Landry and another officer.

Lieutenant Farr was a short, dark-feature man who resembled the planetary locals. MacKinnie wondered idly if he were chosen for the post for his ability to blend in with the rest of the population. Nathan explained the situation, and Farr and Renaldi conversed in the Imperial language for several minutes, speaking too rapidly for even Longway to understand. Renaldi became more and more excited, but the lieutenant spoke with a deadly calm. Although he did not have the intense dedicated look which MacKinnie had noted was common of the Navy men, he never seemed to smile either. Instead, his manner was coldly official with perhaps the merest trace of relief from the boredom of being commanding officer to a post without a mission.

When the conversation was finished, Farr turned to MacKinnie, speaking very slowly. "If he is correct about the details of the contract your King signed, then he can legally do this. We could examine it for you if you'd like, but it might take some

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time. There are no legal officers on this post."

MacKinnie canted his head to one side, realized the gesture was meaningless to the lieutenant, and said, "Thank you, no. I'm sure they drafted it carefully enough." He seized a glass, filled it and drained it off. "Is there any chance of our finding a decent trading community on this planet, Lieutenant? And will we be allowed to go and search for one?"

"The only place I can suggest is the main city, Batav. It's said to be wealthy, although what the locals mean by wealth is not likely to impress you. It is all you will find."

MacKinnie nodded. "Then I suppose we must go there. I can't return to King David without something to show for his investment."

"There are difficulties," Lieutenant Farr said slowly. "The Empire cannot transport you there. The entire countryside is in a state of war, and it is not likely you will survive to reach Batav. We can give you no protection . . ." The officer paused. "But if you must go, perhaps you will find another party of Imperial citizens who set out for Batav. A group of churchmen defied our advice and departed months ago. We have not heard from them, and His Holiness will insist on knowing what became of his missionaries. If you find what became of them, it will make the job easier."

MacKinnie looked at the officer, realizing that if the Navy could not send troops to search for missionaries, it would never attempt to protect a group of colonial traders. Prince Samual's World seemed far away, lost in the swirl of stars above them, and he knew he would never see it again. One thing, he thought, at least they have no way of knowing what we're doing at the old Library, if we ever reach it.

"We'll look for them, Lieutenant." Nathan said. "Now, I suppose we must find quarters in the town, so that we can organize our expedition. I dare not return to my own world without a profit until I have done everything I can do." He turned to Renaldi. "As for you, I understand that the Empire preserves local customs in so far as this is possible. I will live for the day when you return to Prince Samual's World and I can meet you on a field of honor. Presuming, of course, that you have any." When Renaldi made no reply, MacKinnie stalked away.

VIII

The tavern reminded MacKinnie of the Blue Bottle. Even the name was translatable into something close to Blue Wineglass, and it reminded MacKinnie of home. Although it was only an hour past noon, the place was full.

Blatt, Master Tanner, and Hoorn, Master of Drapers, were glad enough to enjoy MacKinnie's hospitality. They finished the first bottle of wine in silence, savoring the rich fla-

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vored concoction the tavern keeper made from the sour local product. It sold at a price almost no one in the village could afford, making MacKinnie a popular man. Nathan watched the two men, once pleasantly stout but now disfigured with the folds of flesh which marked malnutrition. Other townsmen sat in brooding silence, many of them at tables empty of bottles. The tavern keeper had served his tithe, and they had no more credit; but there was no place else to go.

"Is Jikar often like this?" Nathan asked when the bottle was done at last. "Your pardon, Masters, but it would seem that no village could survive long in this state, even one blessed with harbor and fields."

Hoorn cleared his throat and glanced suggestively at the bottle, too proud to ask for more. MacKinnie signaled with a careless wave and was rewarded with burst of activity from the tavern keeper. Except for a small boy of no more than eight years, MacKinnie had seen no one in service to the tavern, yet it was a large place, obviously once a prosperous one. As the new bottle was poured, Hoorn sighed deeply.

"Since *thev* came," he whispered. Then in more normal tones, although still keeping his deep voice low, he added, "Our war fleet was destroyed when *thev* landed. The pirates will not accept tribute from Jikar, we have killed too many of them in battle. Our city is small, Trader, but we were once proud. Now what is there for us? The harbor is closed by the pirates, and the barbarians ravage our fields. Yet *thev* will do nothing. They cannot interfere, they tell us." The Draper's voice rose to a shout tinged with tears. "In the name of the Immortal God, have they not interfered already? They have been the ruin of Jikar!"

"Aye," Blatt muttered. "Our fleet and our army were the same. Both lost. The pastures are burned off, the fields trampled. Oh, we are safe enough within the walls. *Thev* will not allow the town to be sacked. We could wish that they would. Then our young men might take courage and be ready to fight again instead of huddled at the steps of the church to receive alms they once gave, or drinking the tavern keeper's tithe before it can reach the priest. A curse on outlanders." He lifted his glass to toast damnation before he realized who his host was. "Pardon, Trader. You do not seem like one of *them.*"

MacKinnie nodded absently, considering his predicament. On the next day, the landing ship would rise, leaving his crew stranded on the planet, but he had yet found no way to leave Jikar. Just outside its walls barbarian hordes prowled, ready to plunder anyone foolhardy enough to take either road, north or south. Outside the harbor, patrols of pirates based on the islands across the great shallow bay called the Sulawa Sea enforced the blockade of the port, demanding not only tribute but the

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head of the Master of each Guild in Jikar. It was to the credit of the people of the town that no one had ever been heard to speak in favor of dealing with the pirates, except two ancient Guildmasters who claimed they had few years left anyway. Their own councils refused to consider the proposal.

He was told that in the lands beyond the barbarians' deep penetration into what was once civilized territory had created chaos, and no one would answer for the safety of a small party setting out for the Old Empire city nearly two thousand kilometers away.

The Imperials had very little information about Batav. In hopes of finding a local who had journeyed there, Nathan approached the Guildmasters who ruled Jikar, only to find that few townsmen had ever traveled farther than a few hundred kilometers at best, and most of those had died in the brief futile resistance to the Navy. To the Navy, the loss of three hundred and ninety locals was a regrettable incident. To Jikar, it was ruin.

"God is angry with you, Trader," Hoorn said. "A few years ago, Jikar was the busiest port on the coast. Out here we don't have large cities as they do in the East, but there were over five thousand souls in our town, and as many more on the lands around. Trading was good. We had no need of lordlings to fight our battles for us. We were free men, bound to no one, our own protection. The Guilds rule here, not some bone-headed warrior capable of nothing but mounting with sword and lance."

"You speak too hard of the men of iron," Blatt said. The wine was warming him to the conversation, recalling pleasanter times he had had in the tavern. He lifted a blue-tinted blown goblet, the kind which gave the place its name, and drank deeply. "They do nothing but fight, true, yet I think Jikar would never have been free if there were not the marsh lands to our east. It was our curse that the iron men died of plague, their strongholds fell, and the hordes swept past. Before that we had only to fight the few raiders who passed the great houses like thieves in the night. When their full force fell on us we knew it."

"Knew it and won!" Hoorn shouted. "Ah, Trader, had you seen it. Our young men, the sailors from our fleet and the boys of the Guilds, standing with pikes leveled, never giving ground, while the barbarians dashed themselves against us. Glory to the Lord, the field was red with their blood. We took a hundred horses and many ayuks."

Evidently horses and cattle had been brought to Makassar by the Old Empire. Now both ran wild across the plains, hunted by local predators unless protected by men, but managing to survive.

Some of the barbarians also rode the ayuk, a native beast which resembled a moose with long semi-

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prehensile claws and an elongated prehensile snout. It lived on the hive-rats, warmblooded egg layers about seven centimeters long which lived in great colonies with only a few retaining active sexual powers. The hive-rat was one of the most dangerous creatures on Makassar, although it was not carnivorous. It ate the stone-hard local woods with ease, burrowed the ground, and found any plant life edible by humans quite nourishing. It would fight when trapped, and when one was wounded, hundreds of them came to its aid in blind fury. More than one man had died through being caught by them in the open.

"A great victory," Blatt nodded. "One which Master Hoorn could tell you more of, for he commanded for the Guilds that day. Aye, we broke them, but we could not pursue them. Most escaped. Had we forty of the iron men to give chase, the victory would have kept the barbarians from our gates for a hundred yirs."

"Ah." Hoorn drank again. Then he smiled and shrugged. "We can agree the warriors know how to fight. Yet I have in my day seen them turned back from the gates of a city like ours. In open battle. The young men stood to their pikes, and the iron men Master Blatt is so fond of split about them on both sides, afraid to attack. They took no tribute from that city." As Hoorn finished, a young man, tall for Makassar, once quite muscular but now thin like the others, strode arrogantly across the room, his head high in contrast to the locals MacKinnie had seen. He could have been twenty-five Earth years, but he looked younger, and his clothes were subtly different. His trousers were of the rough texture worn by the villagers, but the jacket and cloak were of finer stuff, and Nathan noted that there were discolored lines at the collar, as if it had once been trimmed with something now lost. He recalled that cloth of gold collars and bands were the marks of the Guildmasters.

The tavern keeper gave the newcomer the glass of cheap wine and a thick slice of bread which he served to all daily in lieu of his tithe to the church. The man began to eat without a word.

"That's who you should talk to," Hoorn told MacKinnie. "We should have sent for him. If there is a man in Jikar who can tell you what you'll find beyond the river and forest, Brett can. Or that warrior friend of his."

MacKinnie studied the dark features of the man in question and approved. He might be down on his luck, Nathan thought, but he wasn't defeated. Despite his youth he was more akin to the Guildmasters than the tavern loafers. "Call him over," he said in a moment of decision.

"Singer," Hoorn called. "At your pleasure join us. Our noble friend is a willing host."

MacKinnie learned that Brett was originally from the eastern part of

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the continent, and had made his way slowly across the great land mass, carrying tales and songs. He declined to discuss his ancestry, although Blatt confided privately that the village suspected he was of barbaric descent. Sometimes young men of the barbarian tribes fell into the hands of townsmen or peasants, who kept them as slaves until they either killed them or their captives ran away. In Brett's case, if the speculation was true, he had probably been captured at an early age, for he spoke several civilized languages perfectly.

Other singers had passed through Jikar at one time or another, but Brett was unusual. He had not come on foot, but riding a great war horse, and with him came another about his age, not a singer, but one of the iron men, dressed in armor with a pennant on his lance. He made no secret that he was displaced from his lands to the south, and now rode with the singer across the world of Makassar, selling his services. When Brett came over, MacKinnie questioned him about his friend.

"You do not travel alone, Singer?" he asked, pouring some wine.

"Not for a yir. I teach Vanjynk poetry, he teaches me to fight. Now we are both good at both trades and the living is better." He stared ruefully about the tavern. "Or was. But we will not leave our bones here for Master Blatt to put to earth."

"You would like to leave Jikar, then?" MacKinnie asked.

"Trader, we would pay the man who allowed us to fight for him, be it only that he had sufficient men to cut through the maris. But the maris will stay until they have eaten and burned everything they can find, and as they are not so stupid as the Guilds hope, that will not be before the snows. Then they will leave. At that they will bring you a blessing, Guildmasters."

"What blessing could a horde of barbarians—maris, you called them—bring?" Blatt stood, his wide shoulders almost blotting out the younger man, his great hands, hardened with brine and tanners liquor, on his hips.

"Calmly, calmly, you will alarm our host and the wine will stop," Brett said softly. There was a hint of threat to the voice, a tone one did not take with Guildmasters. "I call them maris because that is what they call themselves. And the blessing is the destruction of the hive-rats. There will be few enough of them when they move on—in fact, that is why they will move on. The ayuks must eat many of them, which keeps the maris moving about the great plains. When the ayuks don't eat, the maris don't eat. Even here they'll finish off all your Earth crops before the ayuks are done with the hive-rats."

MacKinnie listened with interest. "The maris live off their ayuks?"

Brett looked at him in puzzlement. "Your speech is unlike any that I have heard in any land," he commented. "Yet you are not native here, where the maris have not been.

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Where have you lived that you don't know about them? Ah, the cities of the mountains of the north. Well, know, northman, that the plantain of the great flatland is as poisonous to us as most of the other plants on Makassar. It must be true as the priests say, we came here from another star long ago, else why would God have put us where we cannot eat? But the ayuk can eat the plants, and men can eat the ayuk, and drink her milk and even as the maris do, drink the blood of their steeds. Their horses fare better, eating grasses which grow among the plantain, and some maris live from their horses alone, but the ayuk is better. It is not enough, though. Fed nothing else, they waste and die, even as these men here. In your north, you eat the tall grass, which they say came from Earth, and you eat the grotka. But did you eat nothing but grotka, and the swimmers from the sea, you would die also."

MacKinnie nodded. The Imperials had told him of the dietary problems of Makassar. Most of the animal life was edible, but not all of it; and little of the plant life except that which came originally from another planet. The local plants stored up various metals, which gave them their hardness, but also made them deadly. The local animals separated out the metal, although some like the hiverats which ate not only fruits and grains but woody stems were deadly. All lacked essential vitamins. Listening to the singer, he had an idea.

"I wish to return to the mountains of the north," Nathan said. His maps showed that Batav was nestled on the side—the wrong side, from Jikar of course—of the mountain range which ran down the great peninsula jutting from the north edge of the continent. The mountains then curled west before they dwindled away to hills, still high enough to form a natural barrier to the great plains.

"North?" Brett asked incredulously. "How long has it been since you came from there? But you must have come by ship. The land route has been closed for two yirs, Trader. The High King of the Passes is dead, and the others fight for his place. No life is safe, no judges sit, and the people make do as best they can. With your wealth, you might hire enough men to take you south. With me to show the way you could fight through the maris and come to the city-states and kingdoms of the Kepul. But not to the north, Trader. We could never pass the Sangi." Brett tossed off the glass of wine, then waved at a smaller man, fair haired and contrasting with the singer in every dimension, yet bearing the same manner of confidence. The newcomer came forward slowly.

"Trader," Brett said, "this is Vanjynk, the best friend a wanderer ever had. It is tragic that he must roam the lands." Brett poured his friend wine without asking.

Vanjynk nodded to MacKinnie and sat in silence. MacKinnie noted

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that he was younger than Brett, possibly by as much as two of the local virs. Yet he was born of the nobility, while whatever Brett's origin it had not been in an iron and stonewood fortress. The relationship between the men must have been complex.

The other explained to the young warrior what MacKinnie had in mind. "But there is no way through the Sangi," Brett finished. "Or none that I can see."

"Nor I." Vanjynk drank slowly and deliberately, as he seemed to do everything else. "You will not find enough men to take the trail through the Forest. The coast is closed. I do not know the sea."

"The sea." Blatt snorted. "Were there a way by sea half the town of Jikar would be off trading. All your gold will not pay the pirates, Trader, and there is but one warship left in Jikar."

"There is a ship here?" MacKinnie asked. "Is it for sale?"

"For sale?" Hoorn thought slowly. "It belongs to the Ironsmiths. There is little in Jikar that is not for sale, including our daughters' virtue. I could save you money in the purchase, for a fee to my Guild."

"Not allowed." Blatt spoke positively. "To sell a man that which sends him to his death is not allowed. Go back to your clothing, Hoorn, the Guilds cannot plunder this man from the stars."

Nathan noted the sudden look of interest Brett tried to hide, then turned to Blatt. "I buy it willingly, Master Tanner." Although he said nothing to show it, the man's honesty affected him more than MacKinnie wanted to admit to himself. "To return to our homes with nothing would be not only our ruin, but that of many others. Go with Guildmaster Hoorn and buy that ship for me, and we will do well by both your Guilds. Freemen Brett, Vanjynk, I will pay you for your advice, whether you come with me or not; but we are taking that ship out of the harbor of Jikar if every pirate on Makassar is lying in wait out there."

IX

MacKinnie and his party were inspecting their ship when the landing boat rose from the harbor and vanished from sight in the low clouds above. Nathan was not sorry to see it go. He had far too much work to waste time playing a role, pleading with Renaldi or demanding rights from the Navy. The ship was not in condition to be launched.

Midshipman Landry had left with Renaldi. The lieutenant in command of the Makassar station decided that the Navy could ill spare one of its young officers for a year, and it was more than likely that MacKinnie's party would never be heard from again. Landry was ordered to go to the next port and send a message torpedo back to Captain Greenaugh for further instructions. Before Renaldi left, the lieutenant also made it clear that the Navy was displeased with

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his treatment of MacKinnie, and would insist that no matter how remote Nathan's chance of survival was, Renaldi was obligated to provide transportation back to Prince Samual's World. MacKinnie was privately convinced that the lieutenant was more upset about Landry's wasted time than the injustice of the situation, as Greenaugh had been led to believe the boy would be gone only a few months. However, he was now guaranteed passage home if he could return to Jikar.

Mary Graham remained on Makassar. She pointedly refused to be on the same ship with Renaldi without MacKinnie's protection, and she was legally correct by Haven law and custom. This was upsetting enough, but Nathan found she also insisted on accompanying the party on its expedition to Batav, and nothing MacKinnie could say would convince her that she could not go.

"What did you expect me to do here?" she insisted. "I knew there would be danger."

"Freelady," MacKinnie replied coldly, "my lord Dougal sent you without my request. We thought you could remain at the trading offices we expected to establish in the Imperial port and act as our agent. We see that would be useless now, but you will be a great inconvenience aboard ship. How can we provide you proper quarters? To be blunt, what of sanitary arrangements? This is madness."

Madness or not, she insisted, and was now busily clambering about the dockyard, following McLean and hastily scribbling notes as the seaman happily inspected the craft. A gang of young locals, glad of employment, stood by under the supervision of the Shipwright guildsmen. The Shipwrights had lost heavily in the brief and pointless battle with the Imperial Navy, and were willing to allow anyone in the town to work on MacKinnie's outfitting provided that they paid dues to the Guild and worked under its masters. From the crowd inside and outside the dockyard, MacKinnie thought half the able bodied men of the town were there, hoping for employment.

The boat itself was hardly impressive. Only about thirty meters long, it was drawn up out of the water on a primitive ways. MacKinnie saw a round bottomed boat with a small skeg running her length. The stem and sternpost were carried up high out of the water, and a great platform was constructed across the stern. On top of that was a cabin. The rest of the boat was undecked, with platforms for rowers along its sides. Over a hundred men could sit on the two sweeps half decks, but there was no chance of hiring that many for a long voyage, even if the pirates were not outside the harbor. At present, MacKinnie had no crew at all except his original expedition, although Brett and Vanjynk were on his payroll and probably would come if they thought there was a chance of getting through.

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After McLean inspected the vessel, MacKinnie took him to a sheltered space to hold a conference. Hal Stark stood by to be sure they were not overheard, and MacKinnie wasted no time. "Can we make it? It's vital that we get to Batav if we have to swim."

McLean sucked on a pipe casually for a moment. Smoking did not seem to startle the villagers although they were never seen to smoke, but McLean's lighter was forbidden on the planet. MacKinnie wondered how he had got it past the thorough inspection Mr. Landry conducted before they were allowed to unload their goods from the landing ship. The pipe gurgled for a few moments more before McLean said, "Need some modifications to get that far. From what I've heard, this is sheltered water around here, but north a ways there's nothing to the west for five thousand kilometers. Big waves will come across there in a normal westerly. Sure as hell be bad in a storm."

"So we could make it?" When McLean nodded, MacKinnie went on, "How big a crew will you need?"

"Way I intend to modify her, not much more than you've got if everybody lends a hand. Few locals would help if you can hire them. I'm going to make her sail, Trader. She's got that damned stubby mast on her. I'll yank that and put in a taller one. Stay it properly, deck the boat over and put some iron ballast in her. Nothing the Imperials can object to. And I'll mount leeboards."

The term meant nothing to MacKinnie, but he'd find out soon enough. "Sail up high will tip it over won't it?" he asked.

McLean shook his head. "Ballast will fix that, I hope. She's beamy enough, should be good for stability. I like the hull sections. They've ridden out some mean storms in those things. That big iron ram on the prow goes back almost amidships, it's the closest thing they've got to a keel." He sucked on his pipe. "You can tell there's a lot of shallow water here, and those weird tides from the two moons, must run aground a lot. That's why the boats have nearly flat bottoms. Beach them for the night usually, I expect. We can get there, Trader, but I don't know about the pirates."

MacKinnie nodded. "Suggestions?"

"Just fix the boat and hope we can outrun them. Sure as hell can't outfight them. Oh, this is a bigger boat than most of the pirate stuff. Faster. Warship, one of the best on the planet I'm told. But there's a hell of a lot of pirates. Without a full crew, one of their ships boards us, we're dead."

"Yeah. Well, we cross that when it happens. How long to get the work done?" MacKinnie was impatient. Now that he was no longer watched by the Imperials every moment he had control over his actions again, and the new sense of purpose drove

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him impatiently. He glanced about himself, took out his pipe, and borrowed McLean's lighter to fire his pipe. "How'd you get this past?" he asked.

"This?" McLean looked at the lighter as if he had never seen it before. It was an ordinary flint and steel device, not as elegant as the flameless units the Imperial Navy carried. "I just walked out with it. Landry saw it, but he didn't say anything."

MacKinnie nodded slowly. The lighter was primitive enough by Empire standards to be classed with Makassar technology. He wondered how many more Samualite devices were strange to Makassar but could be overlooked by the Navy. He asked again about the time to complete the ship.

"Not much. Few days, with luck. Decking's the hard part, but there's a lot of hands to do the work. Time you get the provisions and goods ready to board, we'll be on our way."

It took two of the local weeks. Although the Makassar day was somewhat longer than Samual's and quite a bit longer than the standard Earth day, MacKinnie noticed that he and his crew soon became accustomed to living by local time, which was measured by sundials or not at all. The Church insisted on Sabbath keeping, and in addition seemed to proclaim at least one Holy Day each week. These, and the inexperience of the locals with the construction methods McLean insisted on caused the first delays. Then when the ship was completed, the second week was consumed in obtaining cloth suitable for sails and having the Drapers sew it. McLean was the only man available to design the equipment needed, and found that he could not see to every detail at once. He designed and cast anchors more advanced than anything seen on Makassar since the War; installed windlasses and winches, cast in bronze by the Ironsmiths; and had the Drapers lay up ropes and cables from local fibers. McLean had to attend to each detail personally, as the days dragged on and on.

MacKinnie watched nervously one day when a party of Imperial sailors led by the junior lieutenant of the planet walked around the dockyards, but they evidently saw nothing to disapprove of. Anchors and winches were things for primitives, and the Navy men did not even understand the purpose of some of McLean's devices. As a precaution, MacKinnie had taught Brett the use of most of them, so that if asked he would appear familiar with the equipment. The Navy might think it in common use elsewhere on Makassar.

By the time the ship was ready for launching, the trade goods and weapons they would carry were piled on the docks. A light drizzle driven by the strong westerly winds thoroughly soaked the party as they stood watching the locals launch the

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ship. The primitive ways did not permit much sophistication—half the young men in the town simply lifted and strained until *Subao* was in the water, then fell to carrying aboard the iron ingots McLean had selected for ballast. MacKinnie expected to get under way immediately, but found that there was more to do.

"Now what?" he asked McLean.

"Masts. Stays. Running the sails up to see how they fit. Securing the ballast. Trader, that ship may be on her ear in a storm one of these days, and you'll hardly want the ballast shifting around down there. And we still have the leeboards. You can save time by getting your gear aboard today but don't plan on leaving for two or three days more."

MacKinnie cursed, silently so that McLean would not hear him. There was little else he could do.

That afternoon, McLean gave instructions on how to sail the boat. He discovered that young Todd had sailed small boats in the Haven harbor and, under MacKinnie's questioning, the boy admitted to being a military cadet from one of the wealthier families of the Kingdom. McLean immediately appointed him midshipman and quartermaster.

They learned the language the locals used aboard ships, although McLean had to adapt several local words for terms they would not be familiar with. Then he had Todd drill everyone else on the names of lines and gear on the ship. MacKinnie noted that Brett seemed very adaptable, learning faster than the outworlders, although his friend Vanjynk was almost uninterested. Stark, as usual, soon learned his tasks and drove the guardsmen to theirs, not a bit upset by Todd's sudden promotion over him. That night, Stark and MacKinnie sat in MacKinnie's small room at the inn overlooking the water.

"Best we get the men some action, sir," Hal said. "All that drill with sword and shield's fine, but they get restless carrying stores and drivin' nails. Got some good pointers from that Vanjynk fellow, he's gifted with this armor and stuff. Reckon he's in the same business we are."

MacKinnie nodded. "From what I can see, it was all he ever learned until he lost his lands and had to go wandering with the singer. What do you make of Brett?"

"Dunno, sir. Takes my orders right enough, bettern' Vanjynk, but there's no understanding him."

MacKinnie nodded. "He's a tough one. That's a pretty strange partnership he's got with Brett. Vanjynk seems to be one of the iron men Blatt forever tells us about." He hoisted his glass and winked at his sergeant. "Iron MacKinnie's new troops. Few enough of them. Had any success at recruiting?"

"That's what I wanted to talk to you about, sir. There's a shipmaster I've been drinking with, man named Loholo. He claims he can get us a crew for a price. Part of the price is

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he wants to go with us. Mr. McLean wasn't too interested in having a native shipmaster aboard, said there was enough bedamned command problems already what with nobody knowing who ranked who. He's not happy with you bein' in charge, sir. But I can't tell about Loholo, the Guild people seem to think a lot of him. Should I send for him? He's in the Blueglass tonight waiting to hear."

"No harm in talking to him. Sure, why not."

Stark nodded and went to the door, said something in low tones to one of the guardmen outside. "Be here in a couple of minutes, Col . . . uh, Trader. Be best if I was on duty when he came in." Stark took his glass to another table across the small room.

Captain Loholo was a short dark brown man stocky and strong looking, with a distinct slant to his eyes, reminding MacKinnie of the starship officers he had seen. Nathan had seen many others of his type on Makassar, contrasting strongly to the tall blond men like Vanjynk. Loholo wore a golden skull ornament in his left ear, and carried a large curved knife in his belt. His clothing was of finer material than was usually seen on Jikar men, and everything he wore was freshly cleaned. He stood self-confidently in the doorway, coolly eying the starmen.

"Trader," Hal said, "I want you to meet Captain Loholo, shipmaster and merchant. I'm told he's the only captain left in the port."

"Please have a seat, Captain," MacKinnie said, pouring a glass of wine. "My guards chief tells me you can raise a crew."

"Aye." Loholo fingered the glass, looked at MacKinnie for a moment, and drank. "Not a very good crew, Trader. The good men are at the bottom of the sea, or run off to join the pirates. But there're men here who can pull an oar. Not seamen. Apprentices from all the Guilds, boys on tithes who'd like to be men again." He spoke so rapidly that MacKinnie had difficulty following him, and had to have Loholo repeat his words.

"I've seen them," MacKinnie said. "But Captain McLean has not been able to recruit anyone."

"Nor will he." Loholo touched the wine bottle and looked at MacKinnie, who nodded. The brown man filled his glass and drank again before continuing. "Your Captain McLean is a strange man, Trader. He puts decks over the ship so that the oarsmen can't breathe properly. He has taken out most of the rowing benches. What's left is up too high for proper leverage. You couldn't row that ship a hundred klameters. And all the iron he put in the hull, dead weight to be carried along. The men won't sail with him because even though they aren't seamen, they can see your man is no seaman. The ship will be too slow to escape the pirates, and it won't . . . it can't . . .

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sail properly if it does get past them."

"But you're willing to come? And bring a crew?"

"Aye."

"Go on. Why?"

"You're not a beached captain, Trader. If you had the sea water in your blood, you'd know. My ship went out to fight with me ashore, laid out by plague. She never came back. Everything I had was on that ship, Trader. Nothing left to buy the Ironsmiths' vessel. Even if a warship is no good for trading, I tried to buy *Sidona* for a ship's still a ship. I figure you'll all come to your senses about the ship when you see it won't work. And you'll need a man who knows how to sail these seas. I expect to be your shipmaster a week after you leave port. If you live that long. But the chance is worth it to me."

One way or another, MacKinnie thought. The dagger at the man's belt had once had a jeweled hilt, but it wasn't meant for show purposes. With his own crew aboard, Loholo could make himself master of the ship if he were that kind of man. He looked over at Stark, who obviously had the same thoughts. Still, there was a way to make use of the man, and perhaps he was honest.

"Your own crew went down with your ship?"

"Aye. Every man. It won't be real seamen I can get you, Trader, but they'll be willing."

"How will you get them to join, with the pirates outside the harbor?"

"Tell them the starmen will protect them. They know what happened out in the harbor the day *they* landed. They'll believe."

"And you don't?"

"If the starmen will help you, you don't need to have the guards captain out looking for men with free wine, Trader. So they won't."

MacKinnie nodded. "What of the pirates?"

"There're ways. I know these waters, Trader. When the moons come together, there's deep water over the reefs. It goes down fast. Get over them at the right time, ahead of anybody chasing you, they never catch you. I doubt the pirates know my waters like I do. We'll have a chance. That is, if you can row the ship. Got to put the benches back in."

"What if I told you," MacKinnie asked, "that after we have returned to Jikar from where we are going, we will make you master of the ship and our trading agent, with gold every month and part of the trading as well."

Loholo looked at MacKinnie closely. "Do not tempt a desperate man, Trader. Do you mean what you say?"

"If you serve me faithfully. The first service is to find a crew of twenty men who can fight. Say that we are insane, but that you, Loholo, will get the ship past the pirates. Get us a crew without talk, and have them ready to come aboard by dark on the morrow."

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"And you'll give me the ship when you return? Mine to sail and command?"

"Yours to sail and command. And the chance at carrying trade from starships all over Makassar. You will become the owner of many vessels if you like."

Loholo grunted. "One is all I need. You'll have your crew, Trader. But this man of yours commands this voyage?"

"Yes. He commands. He has a young apprentice who will be a ship's officer. And there is my guards-captain. But if McLean wants you as an officer, he'll tell you so. I expect he will."

"I was a crewmaster once, Trader. I can be again. Until you need me."

X

They sailed at dawn. Loholo, now crewmaster, had brought twenty young apprentices, all well armed. The stores were aboard, and McLean had fitted the leeboards, huge fanshaped wooden boards pivoted at the small end of the fan and fastened nearly amidships of the vessel. When raised they were like giant shields. MacKinnie got the crew and passengers aboard the night before they were to set out, and watched with interest as McLean and Loholo helped the crew sling hammocks, cursing the men into place in the narrow space below decks.

McLean had placed the quarters in a traditional manner, his own cabin right aft with smaller staterooms to each side for MacKinnie and Mary Graham. Just forward of them, Longway and Kleinst had even tinier compartments, really not much larger than bunks with doors to close them in, then Hal and his guards slung their hammocks in a compartment which stretched from one side of the ship to the other. McLean insisted that two of Stark's men be on duty and armed at all times, posted on the quarterdeck near the greater tiller which steered the ship.

In the first light, mist still rising from the water, the crew was turned out from their hammocks to man the sweeps.

Loholo clucked his tongue at the arrangement. There were no rowing benches, instead the men walked the decks with great oars dipping down to the water, two men to an oar. The ship moved slowly away from the shore out into the bay.

"Wouldn't it be better to go at night?" MacKinnie asked. They stood on the quarterdeck with the other Samualites, Hal and his guards in full armor. Armor for the rest of the crew was piled about the deck in convenient places, secured with rawhide lashings. Just forward of the quarterdeck Brett and Vanjynk stood at the ready, also in armor. It was impossible to make Vanjynk man a sweep, and MacKinnie decided that it would be senseless to require Brett to do so, so the two were carried as guards. Their mounts were stabled in

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the hold with the cattle *Subao* carried as part of the food supply.

McLean measured the distance to the rapidly vanishing shore, peering through the mists ahead and astern before answering. "No, my lord. The night would not keep the pirates from seeing us, and the wind dies away then. By midday, there will be a strong wind as the sea breeze and the prevailing westerlies lie together on this shore. Then we will have a chance to outrun the pirate ships."

"If you say so," MacKinnie said with a shrug. "It's the only chance we have anyway. Carry on, Mr. McLean."

"Aye, aye, sir." There was a note of the contempt seamen have for lubberly owners in his voice, but Nathan saw no reason to make a point of it. He needed McLean to reach Batav. Around him the dawn was already turning the dark water clear. Small fish like creatures swam lazily near the boat, looking at it before they darted away, easily outdistancing the men at the oars in spite of Loholo's shouted oaths. The crewmaster counted strokes in a tireless voice, keeping a steady rhythm not interrupted when he fell to cursing one of the men.

McLean left MacKinnie to stand near the tiller, his eyes on the compass mounted on the small mast just forward of the helmsman. Another mast, well forward, towered above the ship, and on both the sails were laced around the booms, their covers removed and stowed below decks. The sails were ready for instant action. MacKinnie could already feel the morning breeze, coming from the south before it shifted to the west in the afternoon.

Mary Graham and Longway made their way over the slowly rolling deck to stand at the starboard rail with MacKinnie. From the waist, Loholo's call was clear and slightly musical. "Stroke . . . step . . . back . . . back . . . Stroke—"

"Point to starboard, Mr. Todd," McLean said softly.

"Aye, aye, sir."

"We should see the land over there as soon as it gets light," MacKinnie told his new companions. "I understand Loholo thinks we should hug the shore. There are reefs and rocks only he knows, and he swears he can get us through them without the pirates being able to catch us."

"Interesting," Longway said pensively. "Then why did he not take some other ship through there? Why has the pirate blockade been so effective?"

"You're not supposed to ask that," Nathan replied. "But McLean thinks it's worth trying anyway. Add something to our chances, and the further we get before the pirates intercept us, the better chance of coming ashore where there aren't any barbarians." It was getting light faster now, and the shoreline could be seen dimly ahead. Above the fog, fifty kilometers away, the peaks of moun-

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tains flashed whitely in the morning light.

"If we can get to those, the barbarians won't matter," MacKinnie said. "All we'll have to worry about will be the pirates. We could even beach and run for it."

Kleinst stood quietly at the rail, and MacKinnie thought he noted a slight tinge of green to the scholar's complexion. If the young fellow couldn't manage in the gentle swell they were experiencing, he was in for big trouble when the real wind came up, MacKinnie thought. Kleinst had kept out of the way the whole time they were on Makassar, although he seemed to have developed a strange friendship with Brett. Nathan had noted the scholar and the singer conversing over wine in the physicist's quarters at the dockside Inn.

"Where are these pirates, Trader?" Longway asked. "As a practical matter, should we be getting the oarsmen in their armor?"

"Not for hours," MacKinnie replied. "They stay well out of the harbor itself, probably afraid of the Navy boys. But they're out there, all right, just over the horizon. You'll see them soon enough."

It was fully light now, the Eye of the Needle had cleared the land to the east, sending its rays slanting across the sea. The early morning mists vanished rapidly as the ship moved quietly along at a surprising speed. There was no sound but the commands of Loholo, who had lowered his voice until he could barely be understood on the quarterdeck. "Stroke—"

The harbor had dropped well out of sight when the sun burned off the last of the mists. The water was an incredible light blue, the bottom visible not more than three meters below the surface. Long thin fish darted about, pursued by tentacled monsters nearly a meter in length, green eyes glaring after their prey. Larger creatures of the same general form swam into view to look intelligently at the humans on the boat before swimming lazily away. MacKinnie wondered idly what they were when McLean shouted from his post at the mizzenmast.

"Hands make sail!" he ordered.

MacKinnie watched with interest as the Samualites gathered in the waist, then were sent to the mizzen halyards. "Turn her into the wind, Mr. Todd," McLean said quietly. "Stand by to raise the mizzen. Get those gaskets off, there."

Hal and one of the guards took the lacing from the sail, then seized the halyard. "Make sail," McLean ordered. The big gaff rose jerkily, the men on the throat halyards pulling too fast, but eventually the throat and peak rose together. "Take a turn around the winch. Haul, men. Tauten it, that's it. Now belay it all." The gaff sail flapped in the wind, and the boat slowed noticeably.

"Now forward to the main," McLean ordered. "Get it up, smartly now." The men ran forward, and the

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big main, almost twice the size of the mizzen, was hauled up almost as quickly as the smaller one had been. "Man the sheets," McLean ordered. "You fool, that line over there," he added to a guard who stood looking blankly about. "Stand by to trim the sheets, Mr. Stark."

"Yes, sir." Hal answered. He gave MacKinnie a quizzical look and turned back to his soldiers now turned afterguard. The ship was barely moving through the water now, the men straining at the oars, and Loholo stood silent with his hands on his hips looking at MacKinnie as if to say he had told him so.

"Put the helm over, Mr. Todd. Bring her four points to starboard."

The boat turned, and the wind caught the big sails, pushing them off to the right. "Trim those sheets," McLean ordered. "More. Bring 'em in. Strain, you blackguards. Enough. Mr. Stark, I'll have the starboard leeboard down."

The boat was skidding sidewise now, moving to leeward as fast as it was going ahead. The oarsmen struggled to keep steerage way, Loholo back to counting the pace when he saw no response from his silent appeal to MacKinnie. Stark cast off the line holding up the great fan-shaped leeboard, and the heavy wood splashed into the water. An iron shoe along its lower edge sank it quickly.

"Mr. Loholo, get those oars in," McLean ordered. "Quickly, man and get your crew set." The boat heeled sharply to a gust of wind, almost tumbling the starboard crewmen over the side. "Any man can't stay aboard gets to swim ashore," McLean said. "Stark, get those jibs up."

The gust heeled the ship, and the leeboard bit into the water. The boat began pulling ahead, slowly gathering way, until it was apparent that it was rushing along, faster than the oarsmen had been able to pull it, and still gathered speed. A white creamy wake appeared at the bow, and two quarter waves angled off from the stern. It seemed to MacKinnie that the wind picked up noticeably, and the boat was headed into it.

Subao rose gently over the waves, rushing along until Loholo stood looking over the side with amazement before making his way aft.

"Yes, Mr. Loholo?" McLean asked.

The former captain stood looking at his new master in silence, then brought his hand to his forehead in an awkward salute. "She's faster than oarsmen have ever been able to push her, Captain. This may be the fastest ship on Makassar."

"Let's hope so, Mr. Loholo. Faster than the pirates, anyway. Get your men to lookout stations if you please."

"Aye, aye, sir." Loholo turned to his crew. "Banta, up those shrouds. Move along there, lad, and keep your eyes open. Fast as we're going,

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we'll be in pirate waters soon." He strolled along the deck, expertly keeping himself erect, as he placed crewmen in the bow and sent the rest to the waist.

"How does she sail, Captain?" MacKinnie asked quietly.

"Well enough, Trader," McLean answered. "A little better to windward than I'd thought she might. Doesn't point as high as a proper keelboat would, but we can go closer to the wind than anything the pirates have got. That's how I expect to outrun them. They'll have to use the sweeps, and I don't think they can catch us. We'll leave them behind."

"Captain McLean. I think it's wonderful what you've managed to do with this primitive boat," Mary Graham said. She looked up at McLean, then at MacKinnie. "Can I get you anything, Captain? Trader?"

"Chickeest," MacKinnie said. "If you can cook in this."

"If she can't, we'll have cold food the whole voyage," McLean snapped. "This is perfect weather, Trader. By afternoon we'll face some real waves. I'm not looking forward to the tide either. You may not have noticed, but we had a strong tidal current going out. It should be even worse when it turns. Best get some practice in the galley now, Freelady. Take young Brett down to help you."

"All right, Captain." She stumbled across the deck, looking for handholds, then let Brett take her arm to guide her to the companionway. The boat was heeling sharply, the deck standing at perhaps 40° off the horizontal.

It took her nearly half an hour to heat last night's chickeest, and she spilled part of it bringing the pot and cups up to the quarterdeck, but Mary Graham seemed proud of her achievement even so. Now she had the same slight green cast MacKinnie had noticed on Kleinst, and Nathan looked around to see the scholar grimly holding the rail and staring at the distant shore to starboard.

"Sail ahead," the lookout called. "Two sails."

Loholo scampered up the shrouds like a monkey, shading his eyes and staring off where the lookout pointed. He bounded down to the deck and trotted panting to McLean. "Pirates right enough, off the port bow, Captain. Under sail."

McLean nodded. The pirates were to windward, using square sails to run down toward *Subao.* "Steady as she goes, Mr. Todd. Mr. Loholo, it might be best if you stood with Todd at the tiller. Steering to windward's trickier than just watching the compass, and we'll need more helmsmen. Have you any in your crew who might have some ability?"

"None, Captain. They're all landsmen. Willing lads, but no sea legs."

"You'll have to do it, then. Take your post, Mister." McLean cupped his hands around his eyes and stood easily on the pitching deck. True to

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his earlier promise, the sea was running higher now, and *Subao* heeled farther, making it impossible for anyone but the three sailors to stand without something to hold onto.

"Best tack now and get sea room," McLean said. "Stark, get your hands to the jibsheets. The gaffs will take care of themselves. Snap to it man, we haven't all year." Hal and his guards ran to the foredeck, motioning to some of the oarsmen sitting idle in the waist to join them.

"Stand by to let those sheets go," McLean shouted. MacKinnie was surprised to note that the navy man's voice carried easily into the wind, although Brett repeated the order from his post at the mizzen.

"Put her helm down, Mr. Todd." The ship swung into the wind, through it, the booms snapping across the deck. One of Loholo's men scrambled to get out of the way, flinging himself to the deck to allow the main boom to pass over him, while the quarterdeck crew, copying McLean's example, ducked low. The jibs backwinded, pulling the bow around. "Let go the jib sheets," McLean shouted. "Now trim them in on the port side. Snap to it. Man the leeboards! Smartly, men!" The port leeboard was pushed down, and tackles strained to raise the starboard one.

McLean stamped with impatience until the task was done, then turned briskly to MacKinnie. "She's lively enough. Bit slow, easy to get caught in stays. If I end up out of action, remember that. Leave the jibs cleated until the bow's well around, or you'll be in irons." Nathan fervently prayed he would never have to work the ship himself. At least there was young Todd if McLean were killed.

Now they were approaching the pirate ships rapidly, and the lookout called, "Five sail beyond the two ahead, sir."

"That'll be more of the pirate fleet," Loholo said. "Beg your pardon, sir, but the reefs are over there." He pointed off to starboard and ahead.

McLean nodded coolly. "We can't make that course yet, Loholo. When we've sea room, we'll try your advice." He gauged the distance to the rapidly closing pirate vessels. As they watched, the enemy ships extended their oars, the sweeps working rhythmically, rippling down each of the vessels. The pirate ships were much like *Subao* had been before McLean's modifications, with more beam to weather storms in the Shallow Sea but generally resembling her. On the bow of each was carved one of the large tentacled creatures MacKinnie had seen in the water, the stays to the stubby masts running into the nests of arms which jutted forward and upward.

"Idlers below," McLean ordered. "Freelady, Professor Longway, Mr. Kleinst—go below and stay until you're called, if you please. Mr. Loholo, I can spare you from the tiller until you get your men under arms."

"Aye, aye, Captain." Loholo pad-

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ded forward to the waist to arm his men.

MacKinnie watched Hal break out crossbows, handing one to each of his Samualite guards and posting them along the waist. The pirates had noted that *Subao* was going to windward without oars, and adjusted their courses to intercept well forward of their present position, so the ships were not closing as rapidly now, but slowly they drew up to three crossbow shots away to port and as many forward.

"I doubt there will be a battle," McLean said quietly. "Unless they are very much faster with those oars than I think, they cannot catch us."

As if to make his captain a liar, the lookout shouted, "Three sails off the starboard bow. Three sails ahead, sir."

McLean shook his head. "If they adjust to our strange antics as quickly as these did, we'll have to fight after all." He eyed the distance to the nearest pirate ship. "Mr. Stark, I'll thank you to go forward and stand ready to bring the ship about again. Don't cast off that jibsheet until I tell you. And give me five men on the leeboards."

"Aye, sir." Hal took his men forward, carefully seeing that each man stowed his crossbow along the rail on the low side. McLean shook his head. "Put them on the starboard side, Stark. I don't need loaded weapons clattering about my decks when we go about."

"Stand by, Todd. I want to cut this as close as possible without letting them ram us." The pirate ships drew closer now, angling in toward *Subao*'s bows. "Fall away a point," McLean said softly. The ship gathered way, leaping through the water. "Stand by—put the helm over!"

Subao brought up into the wind sharply, hung for a moment, and fell off to the starboard tack. "Let go the jib sheets. Now get them sheeted in. Haul those leeboards!" McLean was icy calm, watching the armored prow of the nearest pirate approaching. The sweeps on the enemy vessel were moving faster and faster, and they could hear a drum beating the count somewhere on the ship.

Zing! MacKinnie heard something snap over his head, and looking up saw a round hole in the mizzensail. Then there was a chorus of sounds, the bolts thudding into the bulwarks. "Get down!" MacKinnie called. Stark, crouching low, half ran the length of the ship to seize his crossbow. All they could see was the great bow of the enemy thirty meters away, white water curling from each side, and the beak of the ram protruding slightly from the water in front of it.

Subao gathered way, and the pirate ship was no longer aimed amidships. "Hold your course," McLean said quietly. As MacKinnie watched, the pirate ram fell behind, tried to turn more toward *Subao*, and caught her sail aback. "Steady as she goes," McLean murmured.

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The pirate ship passed astern so close they almost touched the oars. A cloud of arrows flew from it toward them, and Stark replied with his own volley of steel bolts. There was a shout from the pirate, then it was gone.

"He'll have to get that sail down before he can row to windward," McLean remarked casually. "Never catch us now. Masthead! Where are those other ships?"

"Off the port bow ahead, sir!"

"They're directly to windward," McLean said. "Let's see if they have any sense. Mr. Loholo, you can come back to the quarterdeck now."

"Aye, aye, sir." As Loholo approached, they could see blood on his hands. "One crewman dead, sir. Arrow in his throat. Some holes in your sails, too."

"Yes. Where are those reefs of yours, and when will the tide be out?"

Loholo pointed to a cleft in the hills, along the shoreline. "Right off there, sir. Tide's full now. Going out starting in an hour."

"Excellent. Todd, steer for those reefs and get the picture of them from Loholo. We may make use of them yet. Mr. Loholo, how many men does one of those pirate vessels carry?"

"Seventy, maybe a few more, sir. Not all of them sailors."

"How many of them can fight?"

"Most all, sir. That's why they're aboard."

McLean nodded. "As well they can't board us. Mind your luff there, Mr. Todd, you're too close." McLean looked along the coast, then thoughtfully tossed a light line over the stern, watching the angle it made with the centerline of *Subao*. "Making more leeway than I like," he remarked to MacKinnie. "And that fellow out there seems to have some sense. The others are trying to close with us, but he's standing well out to keep to windward of where we'll be. This could be rather interesting."

They sailed on. The afternoon sea breeze brought a shift in the wind, backing it around to nearly directly off shore, as the tide turned, running little trails of bubbles out to sea. The first group of pirate vessels was lost behind them, and they were easily outdistancing the second, which made the mistake of closing with *Subao* and ended up under her lee before trying to stroke back up to her in the heightening seas. Although they gained at first, the effort was too great for them, and they soon fell farther and farther behind. Now only one enemy vessel remained between *Subao* and open water.

As the chase went on, the shore line fell away to northward, bringing the wind more directly off *Subao*'s beam, and increasing her heel. The animals in the hold below screamed their protest, a shrill keening sound unnerving to anyone not familiar with it, causing Brett to rush below to comfort his horses. The pirate ship ran along the shore line parallel

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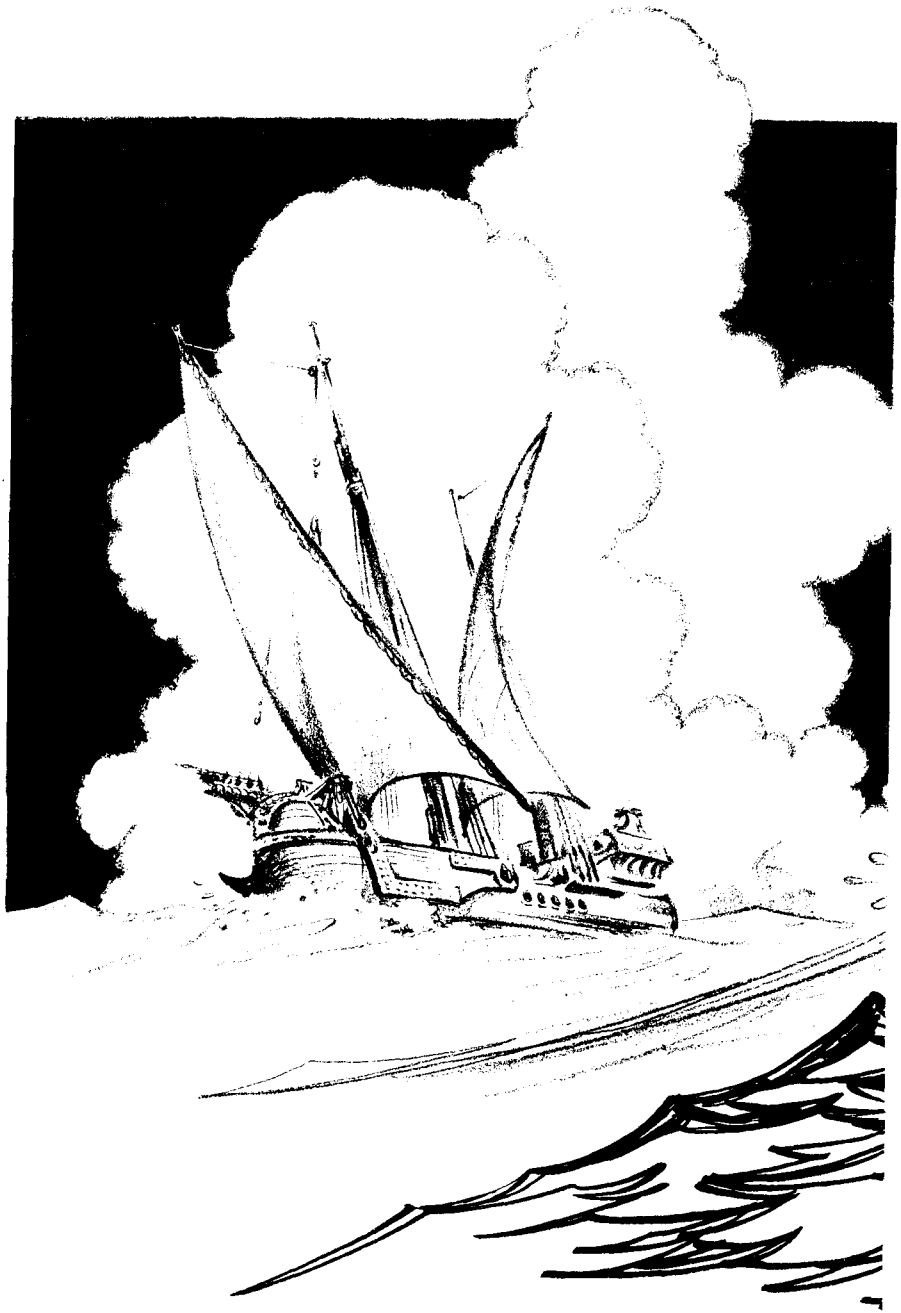

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with *Subao*, slowly drawing closer but taking no chances of losing her prey as the others had done. Her captain had trimmed the great lateen sails the boat carried, and kept only a few men at the oars. McLean stood anxiously at his post, with Loholo now holding the tiller. The crewmaster learned the task far more easily than McLean had thought he would, and now held the huge wooden bar easily, balancing himself against the rolling of the ship and watching the shore line.

"Where are we now, Mr. Loholo?" McLean asked.

"In shoal waters, Captain. With the tide running out, we'll come to ground in another hour."

"Yes." McLean looked out at the pirate vessel. "Nothing for it but to work out some more, even if it lets him get closer. Hands forward to trim sheets," he called. "Take her a point closer to the wind if you would, Mr. Loholo."

"Aye."

On the new course they closed more rapidly with the pirate ship, the tide helping cancel their leeway. In minutes, the current was running so strongly that the line over the taffrail stood off to a 60° angle from *Subao*'s stern.

"Going out fast, Captain," Loholo remarked.

"Mr. Todd," McLean ordered, "get forward with a lead to call soundings."

The cadet perched himself at the shrouds, leaning out to cast the lead line and calling back in a clear voice. "Three meters . . . and a half two . . . three meters—"

"He's closing with us now, Trader." McLean looked at the pirate thoughtfully. "Guards in armor, please. He may be able to board." *Subao*'s ability to point higher than the pirate vessel was almost negated by the strong tide off the lee bow, and the longer waterline of the enemy ship gave her an advantage in hull speed. MacKinnie looked around the horizon. There were no other ships in evidence.

"As good as we could expect, Trader," McLean said softly. "We expected to fight a dozen enemies, now there's only one."

"And a half two—" Todd called. "Mark two . . . and a half one—"

The tide was racing out now. MacKinnie had never seen anything like it, and asked McLean how the current could be so strong.

"Those two close in moons make for strong tides," McLean answered, "and this big shallow basin doesn't really hold much water. Won't take a lot of vertical rise and fall to empty it." The captain looked carefully at the current. "We're going aground in a few minutes, Trader. If we try to run with the tide to keep afloat, that pirate will have us. At least if we're aground, he can't ram the ship. Might be quite a fight when he sees us high and dry. Or he might decide to run out with the current and get his friends. You'll have to decide whether to go ashore in that case."

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MacKinnie nodded. It seemed to him the enemy ship was staying close to *Subao*, and it occurred to him that the pirate might be trapped as well. If they really didn't know these waters all that well, they might think *Subao*'s crew intended to stay afloat.

The leeboard scraped bottom, heaving up ponderously before settling back to its position, then hit again.

"Hands to the halyards!" McLean shouted. "Get those sails down. Move, damn you!" Then in a calmer voice, "Mr. Loholo, put your helm to weather if you will . . . ease her against the current . . . steady—Sergeant Stark, get your men's backs into it!"

The sails were hauled down, the men pulling desperately. Heavy canvas billowed across the decks, and the Makassar crewmen leaped to subdue it. It was bulkily piled on the booms, and lashed in place. The ship swayed, blown against the current by the strong wind, held in place until there was no way on her at all, then began ponderously to make sternway.

Loholo balanced off the helm without orders, obviously he was accustomed to taking ground with ships in the shallow seas of Makassar. As the tide raced away, she settled bow first, straightened, and came to rest on the sandy bottom, angled toward the shore.

"We're fast," McLean said. He looked out at the pirate ship three hundred meters away. "By the Saints, he's caught! He can't make it against the wind."

The enemy crew was straining at the oars, while others gathered the lateen sail against the mast, but even as they watched the stern touched bottom. The tide race was incredibly swift, and within seconds the pirate was stuck as fast as *Subao*.

In the waist of the ship, Brett was struggling with the hatch cover. Vanjynk rushing to help him. McLean shouted from the quarterdeck. "What in hell are you doing?"

"We must get our mounts up from the hold," Brett called. "Vanjynk and I would fight on our horses, Captain."

"Let them," MacKinnie told McLean. "We're outnumbered, and having a cavalry force can help. Look there." He pointed to the pirate vessel. Men were boiling off its decks, but instead of rushing toward *Subao*, they formed ranks on the hard sand alongside their ship.

"My turn," MacKinnie said. "You men see to your armor. Hal, help Brett sway those animals up out of the hold."

The hatch cover was already off, and using the main boom held at an angle by the peak halyard, the two chargers were lifted by bellybands, swayed over the side and set in place on the sand. Brett and Vanjynk scrambled to saddle their beasts and cover them with chain mail skirts.

"What are they waiting for?" McLean asked, pointing at the pirates.

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"They don't know how many we are, or if we have star weapons," Loholo said softly. "They will listen to their leaders tell them of the rich loot, and the insults they have endured from Jikar, and finally they will attack. It will be best if our men are already on the sands unless you intend to fight from the ship."

"Not from here," MacKinnie said. "They've got axes. Give one of them a few minutes unmolested and we won't float off here with the tide. Hal, form the men on the sand behind the ship so the enemy can't see what we've got!"

"Right, Colonel." Pleading and shouting, Stark managed to get the native crew into a semblance of order while his Haven guardsmen took places in a group at one end of the line. Shields glinted in the sun as the men stood nervously.

"Serve out those pikes, Mr. Longway," MacKinnie ordered as the academician appeared at the companionway. "Then you and the others stay below."

"If you order us, Trader," Longway said. "But I can fight." He came fully out on the deck, and MacKinnie saw that the scholar's portly figure was cased in mail over leather. Together they took the pikes from their racks along the bulwarks and handed them over the sides to the waiting troops. Each of the Makassar natives wore a breastplate and greaves, a metal cap, and a short sword, and held a round shield on his arm. The Samualites had mail as well. With their pikes in hand, MacKinnie's small force seemed more disciplined, ready to face an enemy.

"They can fight well if told what to do," Loholo said. "They are young men, but the Guilds begin their training early."

MacKinnie eased himself over the rail to join the small group, leaving McLean and Loholo on the ship. He turned to face his men.

"The important thing is to preserve discipline," he said. "If you stay in ranks, there's not much they can do to you. Keep your shield wall up as long as they aren't close, so they can't bombard us with arrows, and advance when I tell you. I want to hit them with a solid force, not a ragged group of individuals. Hal, have your Haven men form a reserve group behind the main body, and keep their javelins and crossbows ready. I want a solid volley from the crossbows as soon as the pirates get in range, and keep that up until they're too close to reload. Then hold those javelins until I give the order to cast."

"Yes, sir."

"Then wait for my orders. Brett, you and Vanjynk stay with me until I give you the word."

"It is not proper that we stay behind and allow these groundlings the honor of opening battle," Vanjynk said slowly.

"Proper be damned. Vanjynk, if you or Brett start a charge without my orders I'll have Hal shoot you

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out of the saddle. I ask nothing dishonorable, Master Vanjynk, nothing save winning this battle."

"We have agreed to serve the starman," Brett said. "It is proper that we take his instructions, my friend." He clapped Vanjynk on the shoulder. "Besides, what honor have pirates? What is propriety to them?"

"Here they come!" Longway shouted from the quarterdeck.

MacKinnie strode to the bow of the ship and looked around. The pirate group, nearly a hundred strong, was moving slowly and in good order across the sand toward *Subao*. "Hal, get your crossbowmen out at the stern and stand by. Fire when you think they're in range."

"Yes, sir. Guardsmen, right face. March." Stark took his tiny group to the stern and deployed them just beyond it. This put them closer to the enemy than MacKinnie's detachment at the bow.

Nathan eyed the advancing ranks of pirates, now broken up by small tidal pools until there were definite gaps in the formation. There seemed to be no effort on the part of the pirate officer to reform their men.

From what MacKinnie knew of similar groups on South Continent, it was a masterpiece of strategy for the pirates to have formed at all before starting a wild charge.

He waited until the enemy was in range, saw several fall to Hal's first volley, but still gave no signal. Behind him Brett and Vanjynk talked calmly to their animals, but their voices were rising in pitch, eagerness to join battle sounding through the soothing words.

A second volley cut down more of the pirates, and the ragged army of brightly clothed natives, armed only with swords except for a few with axes and shields, curled around toward their tormentors, presenting their flank to MacKinnie.

"Now, men. March out. Follow me and stay in good order. Brett, you and your companion remain behind the shield wall until I tell you."

The pirates were now caught between the two small detachments, but seemed unworried. They began to break and run toward Hal.

"With me, troops!" MacKinnie shouted. "Keep your ranks. Watch the men to either side and stay next to them." He trotted his group away from the bow, angling away from the ship but moving sternward, keeping the pirate group between the two parts of his army. Some of the enemy turned to face him now, others still charging toward Hal, but most concerned about the new danger.

Stark fired one more volley of crossbow bolts and his men dropped the weapons, seizing their javelins. As MacKinnie's group closed with the pirates, Nathan shouted, "Now, Hal." Stark's group ran forward, casting their slender weapons, tearing holes in the ranks of the pirates, and then MacKinnie was upon them, his pikemen thrusting their weapons

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forward, as Hal and the Samualites fell on them with sword and shield from the other side.

On either flank a group of pirates now fought MacKinnie's troops, but the main body held back, unwilling to enter the dangerous area between. Then they suddenly broke directly toward MacKinnie's force, charged forward, ducking under the spear points, closing rapidly with the unarmored men, slashing with short swords. Two of the young Jikaran sailors fell, opening a gap in the line of pikes.

On the other side of the formation, the pirates made no headway at all against Hal and his Wolves. Unarmored, with inadequate shields, they did well to hold Stark back, but by sheer numbers were able to do so. A third group darted between the two formations toward the ship itself, running forward to leap for handholds along the ship's railing.

MacKinnie charged into the gap in the line of pikemen, his sword slashing, shouting to his men to hold firm. A short sword thrust at him, and he parried, beat hard in quarte, following with a cut to the pirate's neck. His enemy fell and Nathan brought his sword in a whistling moulinet to drive back a second attacker. The gap was too wide to hold with his saber alone, and another enemy tried to circle to his left, only to be impaled by the pikemen, his last stroke falling weakly on MacKinnie's mail. Bringing his men together to close the line again, Nathan was able to turn his attention to the group which had charged the ship.

The pirates were stopped at deck level by Longway who stood sword in hand, thrusting at the face of a pirate who had managed to raise himself almost to the level of the thwarts. McLean stood with him, while Loholo, shouting in mad fury, jumped to the sands below with an enormous two-handed sword, whistling it around his head, screaming oaths.

"*Subao* is mine!" he shouted. "Filth, slime at the sea, spawn of unwashed carrion eaters—" He lopped off a pirate's head at a blow, stood with his back to the ship, holding the rest at bay with the fury of his attack.

The pirate chieftain, his rank marked by bright gold bands around his neck and ankles, shouted commands to his men, breaking them away from combat to reform and make use of their superior numbers. At that moment, MacKinnie signaled Brett. Shouting curses, Brett and Vanjynk thundered down on the pirates, wielding their great swords to crash through feeble attempts to parry as the enemy tried to avoid being trampled by their mounts. The beasts themselves fought, rearing up to strike with sharp hooves, crashing down to crush men to the sand. A group of pirates broke and ran as Hal and his shieldsmen closed swiftly in a disciplined formation from the other side, hewing down

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the outer ranks. MacKinnie held his own detachment in place, their spears held out toward the pirates, forming a wall of points, while Loholo continued his mad rush, his great sword singing. The last of the enemy turned, running toward their ship.

Brett and Vanjynk pursued the enemy across the sands, but when a group aboard fired on them with crossbows, MacKinnie shouted them back. He reformed his little command behind *Subao* again, leaving them to rest easy in ranks while he surveyed the battlefield.

He had lost two native troopers, killed when the pirates broke his ranks. Several others had deep cuts, and one had a throwing knife through his shoulder. In addition, McLean had caught a wicked cut across the back of his hand from the dying efforts of a pirate Longway spitted. The others were unharmed. The Haven detachment had been always on the attack and the pirates had little chance of closing with them, nor were their weapons heavy enough to do much damage through chain mail unless given more time than Hal had allowed them.

On the sand between the two boats MacKinnie counted thirty-four bodies, some wriggling feebly. Most lay well away from *Subao*, cut down in flight by Hal's men or the cavalry on pursuit.

"It's always like that," he explained to Longway and McLean as he climbed back on board. "I've never seen a battle where the loser didn't have enough strength at the decisive moment to do something with, but once he loses the will to fight, he's finished. More men killed in pursuit than battle every time."

"But it seemed so easy!" Mary Graham said.

MacKinnie turned, surprised to see her on deck. "I told you to stay below," he muttered. "As to easy, it wouldn't have been if they'd caught us on our decks, swarming around with our troops not in formation and no room to maneuver. They were fools to fight on our terms. What can you serve my men for lunch, Freelady?"

She swallowed hard before she replied. "Will they come back?" she asked. "It will take time to prepare."

"I doubt they've the stomach for it." He turned to Loholo. "Will they try to attack again after we're afloat?"

Loholo shook his head. "We'll both have enough trouble staying off that shore, Trader. There won't be much time for fighting when the water wall comes."

MacKinnie noted that while they had been fighting, the officers had broken out one of the ship's anchors. At McLean's request, MacKinnie had it carried out and laid in the sand on the seaward side of *Subao*. Without the anchor, the ship might be washed ashore by the rushing tide when it returned. This gave MacKinnie an idea, and he gave orders to Brett.

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There was no further action, but Nathan kept his crew in ranks on the sand, allowing them to eat in place. An hour before the tide was due in. Vanjynk's horse was swayed aboard. and the rest of the crew then took their places on the ship, leaving only Brett and his mount on the sand behind the ship. A few pirates approached to within a hundred meters, but the sight of Brett thundering around the side of the ship toward them put them to flight, and Brett returned to his post as Vanjynk fumed in the waist.

"We'll have need of you, Vanjynk," MacKinnie said. "You stand by to carry out your orders." They waited.

"I see it!" Loholo shouted from the masthead. "The tide's coming."

MacKinnie waved to Brett. "Now!" he ordered.

The mounted rider galloped toward the enemy ship, passing it well out of arrow range, going around it until he found the anchor the pirates had laid out beyond their boat. With a quick slash of his sword, he cut the cable, and rode furiously back toward *Subao.* His armor and that of his mount had earlier been put aboard, and as Brett reached the ship, Vanjynk was ready with a belly sling. Rider and animal alike were swayed aboard, as the sound of the water thundering in could be heard. Looking out, MacKinnie could see water no more than a kilometer away. It advanced at incredible speed, a wall of water three meters in height, boiling toward them. The pirates screamed, one standing in the stern of his ship and shaking his fist at *Subao.* There was nothing they could do: by the time they could reach *Subao's* cable, the wall of water would be on them, and it appeared that no pirate was willing to give his life to make trouble for MacKinnie. Their ship was carried relentlessly toward the rocks, as McLean gave the order to raise sail and prepare *Subao* for her long voyage.

XI

The harbor at Batav was lined with stone steps leading to the waterfront, and patrolled by great warships flying the Temple flags and banners, saffron robed acolytes standing in the bows to challenge newcomers. Loholo explained to the guards boats that they were from Jikar, but at MacKinnie's orders did not tell them the ship was commanded by men from the stars. One of the patrol boats escorted them past the chain which closed the harbor, stretched between huge rafts at the end of a log boom.

They were shown to a gray stone dock, a niche cut into the harbor and lined with log rafts so that the ship could be tied up without concern for the enormous tides on Makassar. The harbor was dredged out by convicts who worked ceaselessly at low tide, standing in water to their waists to scoop out mud and sand with

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large baskets, or straining at pumps to force the silt into barges where it was carried out to sea.

"The finest harbor on Makassar," Loholo told them when they had made *Subao* fast to the raft. "The Temple priests keep everything in good order here. One of their junior deacons will be along in a while to make you an offer on your trade goods. You'll do best to stall him until you find what the local merchants will pay for part of the cargo, but you'll have to sell some of it to their holinesses. If you don't, we'll never leave this harbor."

MacKinnie stood on the quarterdeck of *Subao*, watching the traffic along the harbor street in front of him. In contrast to Jikar, there was activity, but not as much as Nathan would have expected for a large city like Batav. There were not many ships moving about in the harbor, either. Draymen unloaded a cargo vessel four rafts down from *Subao*, but the intervening docks were empty, and there was another large space before the next ship.

High above the harbor stood a chalk-white building, flying the banners of the Temple, great red and blue crosses on a field of black, with a stylized portrayal of the Temple itself at the fly. The old Imperial Library had been built of native granite, and had formed a part of the Viceroyal palace. Gargoyles and cherubin were carved in stately rows around its cornice, while Corinthian columns held the four porticos at the cardinal compass points. MacKinnie had seen nothing like it on Prince Samual's world, and found the massive strength of the building impressive, despite its ugliness.

"That's the Temple," Brett said quietly. He was standing on the opposite corner of the quarterdeck from MacKinnie, with Kleinst and Longway eagerly asking him about the city. "God himself built it before the Fall, when we were all starmen here, and He put all wisdom and knowledge in it. But the men of Makassar were proud, and said that since they had all knowledge, they didn't need God. In wrath, He struck at the Temple—see, you can see on the side there where part of it was rebuilt. But before He could destroy it, the priests reminded Him of His promises to our people, and He spared the Temple, but took from us the knowledge of how to use the great wisdom in the Temple. Only the priests know, and they don't know how to translate the words of the angels when they can make them speak at all." Brett sniffed loudly. "That's what the Temple priests will tell you. There was a time when they had believers in every city, and their deacons and acolytes controlled whole duchies and kingdoms. In most places, the true Christians like those in Jikar were a little band forced to hold meetings in secret. But now the Temple people don't control much more than Batav, and their followers in other cities meet in secret and fear for their lives. All

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that happened in two men's lives."

"But what would have caused such a rapid transformation of the religious values of a whole society?" Longway asked with interest. "My observation has been that such changes take a long time unless they come with technological changes. We experienced a comparable collapse of the established church on Prince Samual's World, but gunpowder and discipline and money were more at the root of it than anything else."

"Starman, I don't know," Brett answered. "But strange things have happened to us for many years. The summers are shorter, and the winters colder, and the plainsmen move to the coasts and attack the cities because there is less and less to feed them and their herds in the plains. There are ice floes where there were none before. The people say that God has turned His face from Makassar."

"Ah," Kleinst said. Everyone turned to look at the thin faced scholar, who appeared nearly normal for the first time since going aboard the ship. "Of course. The orbit of Makassar is highly eccentric, and its axial tilt is also high. The two have produced reasonable weather in the southern hemisphere for generations, but now they are getting slowly out of phase with each other. The winters will be worse here, until it is the northern part which is inhabitable. Naturally the barbarians flock toward the equator."

"And, of course, as they move into the more temperate areas, they destroy the civilizations there," Longway added. "But this often produces an internal strengthening of the ruling church. Yet I have heard of cases where when there was already schism, the eroding of the civilization would cause many to turn away from the churches, or look to new ones for salvation. Yes." They stared across the harbor, watching the guard ship.

Mary Graham brought wine and chickeest, one of the guardsmen carrying the heavy tray for her. During the voyage she had developed amazing skill at producing hot meals, even when the ship was running before gales which McLean estimated to be over sixty kilometers in strength. She had trained several of the young Makassar guards to assist her, and quickly became absolute mistress of the commissary department of *Subao*.

"Is that the Temple?" she asked, pointing to the huge structure dominating the city.

"Yes, my lady," Brett answered. "Five hundred priests and deacons, and two thousand guards, are quartered in the cells carved in the walls of that building. Not that their army has done them any good against the plainsmen."

"But what can the barbarians do against the Temple guards?" Mary asked. "You tell me they have no equipment, and the Temple must be

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wealthy if it has so many soldiers."

"They will not fight the way the Temple wishes." Brett answered. "The plainsmen run before the heavy armored men, and when the Temple horses tire, the chiefs bring their clans back with ropes and many of them ride around the iron men, lacing them to their steeds, pulling them to the ground. Or the plainsmen move aside and let the iron chargers thunder past, then attack from behind."

"Mobility against heavy cavalry," MacKinnie muttered. "And the Temple guards are drawn away from the walls so that they have no place to rest and re-form their troops." He nodded. "But Academician, I am concerned about the Temple. Can the priests hold this city and their relics against the enemy?"

"Not for long." Longway answered. "If my experience on South Continent is useful, the people of the city will be weary of the fighting, now that their church is no longer thought to be the voice of God. The priests will never be able to rally enough men to hold those walls if the enemy stays at the gates."

MacKinnie nodded. "I've seen the will to fight collapse before. They become concerned with their comforts and neglect their lives, and soon they lose both. We may have arrived at a critical time."

"But how dreadful," Mary said. "All these people. What will happen to them?"

Brett drew a long breath before he answered. "The men will be killed. The prettier of the women will be carried off and if they are fortunate will find places in the herds of one of the warriors. The youngest boys may be taken in by a clan to be raised as plainsmen. The rest, those who would not fight when the walls were taken, will die to amuse the women of the tribes."

Mary shuddered. "Trader, is there nothing we can do here?" she asked MacKinnie.

"I would not weep for all of the city people, my lady," Brett said. "You have not seen what they do when they find a small band of plainsmen. Life is hard out there, and men do what they have to do."

They were interrupted by Stark and two guardsmen who had been posted at the end of the pier. "Company coming, sir," Hal said. "Not what I expected, those deacons you told me to look out for. Civilians, I'd say." He pointed to the end of the pier, where two obvious magnates approached, guarded by half a dozen well-armed men. "Should I turn out the guard, sir?"

"No, but get as many men as you have ready at the hatches and keep these here on deck. Then come back up when you get the troops posted. Quietly, I don't want to start trouble if there's none coming." MacKinnie watched the group move slowly down the stone pier.

"Greetings," the leading man said. MacKinnie suddenly realized that the tall thin stranger was speaking the Imperial language.

To Be Concluded

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"riddle me this . . ."

The Space Patrol had a riddle—
how to get two hostages out of a fortress.
The answer to a riddle is to riddle it—if you can!

CHRISTOPHER ANVIL

KELLY FREAS

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Roberts eyed the bristling model of the huge space station with no great happiness.

"And," said the Colonel, rotating it to bring another rank of fusion turrets into view, "three battalions of crabs are on internal guard duty in this place."

"Hm-m-m," said Roberts, studying the big metal gate below the latest set of turrets. "We're sure two of our men are alive in there?"

"Positive. We're still getting random signals from the deep implants. They're alive. Under torture."

Roberts turned the rim of a little wheel that rolled the model over, and rapid-fire guns and missile snouts protecting the gate came into view.

"Naturally," said Roberts, "if we blow the place up, we kill our own men."

The Colonel nodded. "As a matter of fact, there are quite a few things we *could* do. We have a distinct advantage in technology over these crabs. But if we're not careful, the prisoners will get killed."

"Yet, if we leave the place alone, they'll continue to get tortured?" Roberts asked.

"Exactly."

"Suppose," said Roberts, "we put a stiff threat to the crabs to let the men go, or else?"

"The diplomats have already done it. The crabs deny any human is in there. That's as far as the diplomats are prepared to go for us. Earth isn't going to declare war on Crustax for two apparently ordinary spacemen, and Crustax knows it."

Roberts turned the model slowly around, and watched the successive ranks of gun turrets swing into view.

The Colonel said, "Normally, an entire Crustaxan fleet is within easy reach of this strong point. But the crabs are minus one fleet since they tried to gobble up Storehouse. They're shorthanded, and they're shuttling fleets around to try to hide it. This place was covered last month, and it may be covered again next month. Right now, there's nothing between us and it but a few light scout ships and an outdated cruiser."

"What's behind that gate?"

The Colonel pushed a button, and, on the model, the huge doors rolled back, to disclose a vast lighted interior with big ships at docks, or floating free inside.

"All the guns," said Roberts slowly, "are on the *out*side?"

"The big guns. But don't forget, the three battalions of guards are on the *in*side."

"How good are they at torture?"

"They have a natural talent for it."

"Where are the captives from?"

"Paradise," said the Colonel. He added dryly, "I'm referring to the planet by that name, of course."

Roberts blinked. "Where Hammell, Morrissey, and I were marooned?"

"The same, Roberts. As a matter of fact, these men volunteered out of loyalty to you. They were newly trained technicians on the planet,

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and after studying the last exchange of messages, they came to the conclusion that the Interstellar Patrol is actually the 'Royal Guard.' Don't ask me to explain their reasoning. That want-generator you used on the planet* had a powerful effect. At any rate, they're good men."

Roberts swallowed, and with an effort, relaxed. When the Colonel had said, "these men volunteered out of loyalty to you," this for some reason had made it a personal matter for Roberts. Roberts was, therefore, going to free them—or the crabs were going to pay a steep price in blood. Roberts wasn't sure this was the right way to think, but it was the way he *did* think.

The Colonel glanced seriously at Roberts.

"You see the problem. If we destroy the place, we destroy the men. If we don't destroy it, we leave the men to be tortured. But there's more to it than that. If we go there in an unarmed ship, we can very likely get inside; the commander of this fortress would be very delighted to have some more Earth prisoners. But even assuming that you got in, surprise them, and free the prisoners, how do you get away afterward in an unarmed ship? There are those weapons on the outside to deal with. The likelihood of capturing all those turrets from inside is very small. On the other hand, you can go there in a ship that can handle the weapons—and then the crabs will never let you near the place without a fight. That would defeat our purpose."

"Fine—except that the Crustax Fleet goes in for camouflage in a big way. They have dreadnoughts rigged out to look like big supply ships. Their larger supply ships often look like dreadnoughts. You can't tell who is what without the best instruments. The natural result is that they are suspicious of other people's ships, and if we go in there in a battleship fixed up to look exactly like a large spaceliner, they will automatically suspect what it really is. Their detection instruments are nothing special; but where trickery is concerned, their naturally deceitful character gives them a running start."

Roberts considered it, frowning. "And what do they gain by all that?"

"It's ingrained in their character to start with. Until the adult molt, their whole life is spent *in the sea.* The ocean on Crustax sounds at least as bad as the ocean back on Earth. Only the toughest and most wary survive. Since a lot of the things in the sea are bigger and faster than they are, they find deception very handy. Once they get out into space, that's just a bigger ocean from their viewpoint, and they use deception there, too. It's automatic."

Roberts looked at the model thoughtfully.

"What kind of individual is in charge of that fortress? Assuming we know."

* See "The King's Legions," *Analog*, September, 1967.

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"A fanatic by the name of Garvast Nade. Garvast Nade is the 'son,' so-called, of Arvast Nade."

Roberts said, "Arvast Nade—?"

"Was blown to bits, with his whole fleet, in the attempt to capture Storehouse."

"Hm-m-m. Therefore Garvast Nade—"

"Garvast Nade has had his career wrecked by the obliteration of his 'father's' fleet and reputation. As nearly as we can follow it, a 'family' on Crustax is strictly a voluntary matter of an adult selecting promising young who have survived to the adult molt, with the young, in turn, hunting for a strong adult sponsor."

"Therefore, Garvast Nade has reason to seek revenge on humans? Assuming that is, the crabs have emotions."

"Oh," said the Colonel, "they have emotions, all right. If anything, they have more emotions than we have. You're right, Roberts—Garvast Nade, a fanatic selected by a power-hungry conqueror, has plenty of reasons to seek revenge on humans."

"How *smart* is he?"

"*That* we don't know. Supposedly he has brains, or Arvast Nade wouldn't have sponsored him."

Roberts eyed the dark-gray model with its yawning gate and ranked turrets, and suddenly had a sensation like a cold wind on the back of his neck.

The Colonel sat back, and cleared his throat.

"Our men are very seldom captured. These two were caught while serving on the crew of a fast freighter belonging to a small outfit that handles some of the toughest shipping jobs in this end of the universe. Our men were there to try to track down a very peculiar recent shipment, but we now think we had the wrong ship. The head of this shipping company changes the names of the ships arbitrarily, and shifts the officers around at will, which can make it exasperating to try to decipher what happened. At any rate, the ship got off course, and Arvast Nade captured it. When he got through with the prisoners, he passed the survivors over to Garvast."

The Colonel thought a moment. "As I say, Roberts, we don't have many of our men taken prisoner. But if they are captured by a humane opponent—and particularly if we have no reason to believe they are known to *be* our men—then we usually make no special attempt to free them. Sometimes, their friends get them out. Usually they can manage it themselves. But this, you see, is a little different."

Roberts nodded.

The Colonel said, "We aren't going to leave them there. We will either get them out, or something unfortunate is going to happen to this space station." The Colonel looked at Roberts. "This strikes me, Roberts, as being suited to your special talents, and I am turning it over to you."

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"Thank you, sir," said Roberts, ugly sensations alternating with the chill at the back of his neck. "And what can I have to do this job?"

"Whatever you can lay your hands on," said the Colonel, eying the model with no very pleasant expression. "Whatever isn't already nailed down tight by somebody else is yours."

Roberts smiled at the wording of that stroke of generosity. That meant that things were so tied up already that the Colonel could think of no adequate force to give Roberts, and so he, therefore, left it up to Roberts to scrape one together himself. On the other hand, that particular wording might prove useful. At any rate, it placed no limitation in material on him.

"Yes, sir," said Roberts. "I'll get started right away."

Roberts saluted, and went out immediately.

The first thing to do, he told himself, on the way down the corridor, was to get hold of his men. They, at least, would not have been assigned to some other job without Roberts knowing about it.

Roberts shoved open the corridor door to the room they shared while on the dreadnought, passed the bunks and desks to pause at a hatchlike door beyond the thick window of which the sun shone brightly on dazzling sand stretching down to blue and white water. Roberts frowned, momentarily distracted.

This gigantic dreadnought that served as an approximation of home contained a number of features Roberts didn't understand. The door from the corridor invariably and without delay listed who was assigned to the room—but Roberts never saw anyone put the names on the door. The door apparently put the names there *itself.* The hatchlike door here at the opposite end of the room, whose window looked out on a sandy beach, was sometimes brightly sun-lit, and sometimes looked out on terrific storms. It was obvious to Roberts that the dreadnought didn't carry a private ocean around inside of it, and also didn't have its own internal sun. Which of Roberts's theories explained the situation, he didn't know, but he looked out exasperatedly, then shrugged, and changed into a swimsuit. He stepped out the door, felt the sunlight hot on his skin, and pulled the door shut behind him. As he walked out, scanning the dazzling beach, with its march of white-capped waves rolling in, a strongly built figure burst from the water and plunged ashore.

At the same moment, Roberts's feet got the message to him that he had walked out onto the equivalent of a bed of hot coals. He sprinted across the dazzling beach, his feet sinking deep in the burning sand, and was down the slope till suddenly he was on dark wet sand, and then he dove headlong into the water. The icy shock slid over him,

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taking away his breath. He surfaced, shook his head, and saw the powerful figure of Hammell standing on the wet sand, watching him with a smile.

Roberts swam back, and waded out onto the shore, the water curling around his feet as it ran far up the beach. Roberts called to Hammell.

"Where are Morrissey and Bergen?"

Hammell grinned, and pointed seaward. "They're racing me to shore."

Roberts glanced out, to see the flash of an arm a hundred feet or so from shore. An instant later, he saw, still further out, another swimmer.

Roberts shook his head wryly, and waited.

Hammell picked up a towel, dried himself briskly, and spread the towel neatly on the hot sand. He lay down, stretched out comfortably, and assumed a drowsy air as if he had spent the last half hour sunbathing.

Nels Bergen, chest heaving, short hair plastered to his skull, staggered ashore. An instant later, he was followed by Morrissey.

"This time," Bergen gasped, nodding to Roberts, then glancing around, "we *beat* him." He paused abruptly, looking past Roberts. Behind Bergen, Morrisey shook his head ruefully. "When he hits the water, he turns into twins. One drowns in our wake. The other materializes at the finish line."

Bergen glanced at Roberts. "Can you beat him?"

"Not me," said Roberts. "He's got a little submarine hidden around here, somewhere. You can't win."

Morrisey waded out, grinning. "What did the Colonel have to say?"

"Plenty," said Roberts.

Hammell opened one eye.

"I hope you told him we were looking forward to a long drowsy vacation."

"Strange to say," said Roberts, "I forgot that. He was busy telling about a couple of guys who are prisoners of Crustax. It seems that the crabs have them locked up in a space fortress with three battalions of guards, and enough guns and launchers on the outside to stand off a Space Force battleship."

Hammell frowned and sat up. Morrissey and Bergen stood breathing deeply, and listened closely as Roberts described the situation. At the end, Hammell lay back, frowning.

"How do we get to them?"

"It seems to me," said Roberts, "that the situation has to be so arranged that the crabs gladly take us in because they *want* to."

Morrissey cleared his throat. "They'll *want* to, all right. This Garvast Nade will be happy to have us."

"Sure," said Bergen. "He could use more material."

Morrissey nodded. "The more information he can get, the better the crab high command will like it, and him. To say nothing of the personal gratification."

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Hammell frowned. "Has it occurred to you that this thing has the elements of a baited trap? These two prisoners are the bait. This space fort is the trap. We go in the open door, the door closes behind us—and then what?"

Roberts said, "It seems to me there are possibly four times when we could be trapped. First, on approaching this fort, when the Crustax fleet could show up, and catch us between their ships and the fort itself. Second, we could be trapped with our ship inside the fort's spaceport, when those gates you speak of shut behind us. Third, we could be trapped when we leave the ship to get the prisoners. And, fourth, after we pass out through the gates, again their fleet could turn up."

Hammell nodded. "Then, on top of that, they might get on our ship while we're in their fort, and where does that leave *us*?"

Bergen said hesitantly, "Could we possibly disguise our ship to look like one of them, and slip in unnoticed."

"Maybe," said Roberts. "But we couldn't fool them for long, especially once we got inside."

Morrissey said, "What do we have in the line of captured recognition signals, code books, and so on?"

"Only a few outdated ones turned over to us by the Space Force in repayment for past services. They'd give us more, but they don't have them."

Hammell said, "The more I think about trying to camouflage our ship to look like theirs, the less I like it. On top of everything else, how do we fool Garvast Nade when we don't know how Garvast's mind works?"

Morrissey said, "We know he's *hostile*."

"And," said Roberts, "naturally good at detecting camouflage."

"Suppose," said Bergen, "we camouflage our ship as a freighter—that is, a human-style freighter?"

Morrissey shrugged. "He'll spot the fakery."

"But then, said Roberts suddenly, "suppose we camouflage the imitation freighter as a warship. Knowing, of course, that *they will detect the harmless freighter underneath.*"

Bergen looked surprised, then nodded enthusiastically.

Hammell sat up. "Not bad. They'd figure we were easy to take."

"Hm-m-m," said Morrissey. "A subtle approach. But what if the outer camouflage job fools them, and they don't let us in?"

Roberts said, "We can't take that chance. There has to be a flaw."

Morrissey shook his head. "They may not detect the flaw. Remember, they aren't as familiar with our warship designs as we are. And then, if they *do* detect it, how do they explain that we put the flaw there? The trick will be obvious."

"Not," said Roberts, "if it is a *Crustax* warship."

Hammell and Morrissey glanced at each other. Bergen looked impressed.

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"But," said Hammell, "how do we explain our own reliance on the out-of-date recognition signals? How do we talk with the fort? How do we convince the other side that we even *thought* we had a chance to fool them in the first place? We have to reasonably *think* we're convincing, or they'll look for some trick in our arrangements."

"We can talk to them by message machine only. Our ship, you see, will have been badly damaged. Everything but the message machine was smashed *in the attack on Storehouse,* and that is the only means of communication we can use."

The other three men looked briefly intent, then Hammell cleared his throat. "In other words, they detect that we are trying to gain entrance by disguising ourselves as Crustaxan survivors? So they rub their hands, and say, 'Step right into my parlor.' "

Morrissey said, "That might work. That is to say, it might get us *in* there. *Then* what?"

"In an operation like this," said Roberts, "a certain amount of improvisation is unavoidable. It seems to me that the main thing is to get in."

"O.K., let's try it for size. I'm the crab general and I see this wrecked dreadnought show up. It flashes the outdated recognition signal. For an instant, I don't know what to think. The message comes in, explaining that nearly all their communications are knocked out. Suddenly I spot an obvious flaw on this battleship—"

"Dreadnought," said Roberts. "Inside, under two layers of camouflage, we want something no smaller than a battleship. It follows that the outside has to be *big.*"

"Dreadnought," corrected Hammell. "Suddenly I spot an obvious flaw on this dreadnought, check my detectors carefully, and realize an Earth ship is underneath. O.K.—what *kind* of Earth ship?"

"Hm-m-m," said Roberts. "It should be something harmless. Preferably, something they'll be delighted to let in."

"How about a colonization liner? One of the big ones that takes colonists from the colonization centers out on the first leg of the trip?"

"Yes. They'd like that. With enough cunning, they could use the ship later for deception of their own."

"So far so good," said Hammell.

"Now," said Roberts. "About this error that has to be obvious to them and not us?"

There was a silence, then Morrissey suggested, "Could we make this ship a mirror-image of what it's supposed to be?"

Roberts said, "Or suppose the *scale* of the ship were slightly wrong?"

Hammell nodded. "There is something they would spot that, we supposedly working from photographs, rough readings of mass, and so on, might have wrong. However, there's

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still a slight hole in this plan. What do we do after we get inside that fort?"

Bergen said, "We could pound it to pieces from inside."

Morrissey suggested, "What if we tell them we're packed solid with atomite? Release the prisoners or we'll blow the whole place up."

"Great," said Hammell. "This fanatic, Garvast, might tell us to go ahead. Then where are we?"

"It seems to me," said Roberts, "that we've got to risk landing on this place. From past experience, I think our battle armor will protect us in close fighting."

"What about the three battalions of guards? You know we aren't going to get any army to transport with us. It's bound to work out that the four of us have to do the whole job."

"If," suggested Roberts, "we could first get them to board *our* ship—"

Hammell looked thoughtful.

Bergen beamed. "Trap them!"

Morrissey looked uncomfortable. "And suppose they capture the ship?"

Hammell's gaze was remote and calculating. "Personally, I'd hate to capture even an Interstellar Patrol scout ship. A *battleship*, now—"

Bergen's eyes shone in creative effort. "We can put false walls, and line the corridors with mines and automatic guns. Nothing will fire till they're well inside."

Hammell cast a fishy look at Bergen, and glanced at Roberts, who said, "We'll leave that end of it to you, then, Bergen. But we're going to have to do a little more work on this thing. A possible plan is only the first step. Next we have to work out the alternatives in case the crabs don't cooperate with us at any given point."

Hammell said, "Let's allow enough alternatives so we don't have to improvise too much after we get in there. It isn't healthy to rely on having strokes of genius when you get in a tight spot."

"Unfortunately," said Roberts, "we don't know for sure what they've got in there, so we can't help improvising. But we'll eliminate it so far as possible."

"Just so it's a well-planned operation," said Hammell, looking uneasy again. "Otherwise it could be a mess."

"We'll do our best," said Roberts.

From the relay center in the interior of the imitation space liner, the view from the imitation wreck's forward pickups flashed onto Roberts's viewscreen in the battleship. A brief winking of lights was all that visually showed the existence of the Crustaxan space fortress as they approached. All that is, except for the blotting out of the stars by the looming bulk of the place.

There was a clacking noise, and Roberts watched the message as it slowly came out of the machine. Across the room, a small language computer clicked and hummed, apparently laboring to keep up with the

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incoming signal. These noises, Roberts thought, could not be a result of the computer's actual operation; they must have been added as a guide for the user. If so, the computer wasn't having an easy time with the message. The clicks came slowly, then in brief bursts, and the computer's hum sounded high-pitched and strained. Then, with a final burst of clicks and a corresponding series of clacks from the printer, the message wound up out of the printer. Roberts pulled it free, to read:

Seal Ready
Stamp-Emblem Ready
Number One Paper
Strike: Embossing Master Emblem Number Two
**** Border

Begin Message
From:
Commander
Space Fortress *Ironclaw*
To:
Commander
Unidentified Damaged Warship
Sir:

Your ****-signal received and acknowledged herewith. This is the correct signal for the ****. However, we require the following information:

1) Who are you?

2) What is the name of your ship?

3) What are the circumstances surrounding the **** of your ship?

This information must be forwarded at once, or we must refuse entry. Stand off while replying.

Cordial claw-claspings,
Gratz Ialwo,
Commander
Space Fortress *Ironclaw*

Fold Message and Glue Shut
Stick Seal
Stamp Great Claw on Front
Eject

Roberts looked up blankly.

Who was Gratz Ialwo?

Across the room, Morrissey straightened from the visual display, as the battery of detectors labored to unravel the details of the fortress.

"Still clear as mud," growled Morrissey.

Roberts turned to the printer. How would the message he was about to send, which was slanted for the fanatical Garvast Nade, affect "Gratz Ialwo"?

A hatch came open, and Hammell stepped in. "Everything's set," he said, then glanced again at Roberts. "What's wrong?"

"Gratz Ialwo."

Hammell glanced at the printer, then at the message, but kept his mouth shut.

Roberts decided to send the original message. He snapped a little spool into the sending device. The printer clacked. Across the room, the translator labored, to produce a translation of the message just sent. Roberts ignored the coded instruc-

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tions for the receiving printer, and read the message:

From:
Arvast Nade
Commander, Fleet ****
To:
Garvast Nade
Commander Fortress ****
Sir:

I **** survived the **** suffering **** this ship severe damage, **** and **** and **** receiving apparatus out of order. No ****. Vital information relative Earth **** at **** **** without delay. We **** enter fortress. Vital **** **** surprise **** coming, urgent **** at once.

Signed,
Arvast Nade
**** Fleet ****

Roberts glanced back at the screen, and saw nothing but a huge blackness, with stars showing around the edges. He glanced around the control room, seeing Morrissey at the forward detection screen, and Hammell now by the manual fire-control bank, the big manual-override lever shoved back in the "off" position. Roberts was by the pilot seat, the printer to his right, and the seat to his left, with the screen above the curving control panel before the seat.

Roberts, looking around, had the sensations of a frontier-raised colonist, seeing a miniature power-unit for the first time.

Roberts's Space Force training told him that this little room could *not* be the control room of his own patrol ship. And yet, as he'd seen clearly enough when he first boarded it, it *was* a battleship, and no doubt of it.

Morrissey said, "That monster gate is starting to open. It's like a big metal curtain sliding up from the center, while another half slides down below it."

"Good," said Roberts.

Hammell said, "Have they answered the message?"

"Not yet. Where's Bergen?"

"Still improving his traps."

Roberts slid into the control seat, and reached out to reset the screen. A slightly different model from that on his own ship, this screen's differences bothered him. Yet when Roberts punched the "split-screen" button that was awkwardly located just above the course display, the button refused to depress. Irritated, Roberts pushed harder. The button yielded slightly, then shoved up against his finger, to recover its original position.

Roberts growled to himself, stood up, leaned forward, put his thumb on the button, and shoved down hard. The button resisted, then went *click*. The screen divided into two sections, the external viewscreen to the left, the battle screen to the right.

"Good," growled Roberts, at once feeling more at home.

There was a loud *clack!* from the

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printer, and just then Morrissey called, "Look at that gate!"

There was a *click* as the split-screen button depressed by itself, and a *snap* as a stubby lever below the screen jumped into a new position.

Roberts, just reaching out to take the message as it came from the printer, caught the motion, and realized that the ship had just canceled his directions. Instead of providing both battle and viewscreen, it chose to provide a single larger battle-screen view. There was another *snap*, and a small auxiliary screen to the left came on, to provide a small external view, apparently to placate him.

Roberts irritatedly tore the message from the printer, noticing at the same time what Morrissey was pointing out—an iris-of-the-eye effect that followed the separation of the two sliding gates. Behind the big sliding gates, there remained a separate gate, like the shutter of a huge camera, and this gate had moved only enough to show a relatively small opening at the center. This mechanism hadn't been present in the model the Colonel had shown Roberts, which at once raised the question what else might be different? Unlike some other organizations, the Patrol didn't hesitate to use very advanced—but somewhat bug-ridden—techniques. This generally gave good results—but it could also give surprises. How had they got the information on that fortress? Then Roberts shrugged and read the message:

From:
Commander
Space Fortress *Ironclaw*
To:
Arvast Nade, Commander
Survivors of Meteor Storm
Sir:

Welcome, survivors! Your ***** fleet believed lost without *****. You may enter ***** gates at once

Sad news must ***** *****, the death of Garvast Nade following your reported loss. I, Gratz Ialwo, the closest ***** of Garvast Nade, welcome you as a *****.

Reverent lowering of antennae,
Gratz Ialwo, Commander
Space Fortress *Ironclaw*

Roberts glanced from the message to the screen, where the inner gate was steadily opening wider. Apparently, despite everything, Ialwo was fooled so far. Now Roberts's detectors picked up a transparent membrane that ballooned out as the gate opened, apparently to prevent the loss of an internal atmosphere through the opened gates.

Roberts leaned across to the printer, tapped out the usual heading, and then the message, hitting the "garble" button frequently:

Sir:

Our ***** severely ***** by damage and reception is *****.

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We wish to enter, and request assistance ***** *****. Severe ***** of ***** causing recurrent difficulties which urgently need ***** without delay.
***** *****

Arvast Nade, Commander
Fleet ****

Morrissey called, "The gate is almost wide open."

Roberts glanced at his screen. "It took them long enough."

"Crab technology seems to leave a little something to be desired."

Roberts aimed the ship at the center of the opening, and guided it toward the interior.

Hammell looked at the scene of the gigantic interior that was opening up on Morrissey's screen, as the camouflaged battleship glided in. He murmured, "Quite an effort we're making to save just two men. I hope they appreciate it."

Morrissey said uneasily, "We haven't saved them yet."

Roberts snapped a communicator switch, and said, "Personnel Monitor—locate Nels Bergen, and tell him to come to the control room."

Bergen's voice at once came out a small speaker to the right of the screen.

"Be right there, sir. Where are we?"

"Almost inside."

Roberts was studying the view on the battle screen in puzzlement. The screen was blinking, switching rapidly from one view to another. The first view showed the spaceport facilities as seen by their own lights, and by the light floating globes or lightships that drifted in the interior. The second view, apparently taken from the same viewpoint as the first, showed ranks of guns and odd shieldlike objects in a somewhat larger space than the first view showed.

Slowly, the wrecked imitation dreadnought entered the spaceport. Now it moved slowly ahead, completely inside, the transparent membrane pressed tightly around it by the artificial atmosphere of the spaceport.

Roberts alertly studied the screen.

Morrissey said sharply, "The inner gate's *closed!* It *snapped* shut!"

Roberts glanced at a small auxiliary screen which showed the view to the rear. Where the open gate had been, there was now a solid surface with a massive grille sliding quickly down across it.

With a puff of briefly visible vapor, the membrane expanded, came free at one edge, and drifted away from the ship.

The printer clacked.

Roberts read:

No Seal
No Stamp
Shoddy paper
No Embossing
Tide-Dregs Border
Begin Message
From:
Commander
Space Fortress *Ironclaw*

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To:
Most Honorable
High Admiral
Arvast Nade
Commander
Battle Fleet IV
Most Honored Sir:

***** abasements before your noble self as you enter, crowned with victory.

We beg you to emerge from your victorious vessel in order that we may properly welcome you.

Servile clutchings of sand before you.

Gratz Ialwo, Commander
Space Fortress *Ironclaw*

Fold Message Without Glue
No Seal
No Stamp
Eject

Roberts glanced quickly at the screen.

Several of the glowing spheres were coming closer, to illuminate the hulk. A small plain vessel of some kind was starting out from a distant dock.

Roberts reread the message.

"We seem to have made the wrong approach to this outfit somewhere."

Hammell was studying the fort through the master-control viewscope. He growled, "It looks to me as if this place is well armed, but the weapons are hidden behind all this loading equipment." He looked up. "What's wrong?"

"Take a glance at this message."

Hammell read it, grunted, and passed it to Morrissey. Morrissey and Bergen read it together. Bergen whistled.

"Shoddy paper, and 'Most Honored Sir,'" said Morrissey. "It sounds as if they want to carve Nade up the middle."

Hammell looked into the viewscope. "That boat must be coming out to get him. They seem heavily armed."

Roberts glanced at his viewscreen again. Suddenly the scene readjusted. The approaching boat filled the screen, and an abrupt shift in focus showed the still further magnified interior through a large viewport in the front of the boat. This showed what looked like large lobsters in space-armor, carrying guns, moving into position behind the side hatch of the vessel, while other lobsters looked grimly out the front.

Somewhere in Roberts's ship, there was a low rumble, then a voice spoke quietly but firmly:

"The four volunteers will prepare to don armor and enter the Crustaxan fortress."

Hammell looked grim. Morrissey winced, as Bergen nodded and looked pleased. Roberts glanced around moodily as four lockers opened up. He studied irritatedly the four suits of battle armor that slid out into view.

"It won't work," he said. "They're too clever."

The battle armor had two large upper arms, with room for big pinch-

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ing claws, along with what looked like a kind of trapdoor in the chest. The lower half looked relatively normal save for a kind of thick tail or extension of some kind in back. A quick glance at the viewscreen showed Roberts that this much was "normal" for the inhabitants of the fortress. But the business did not stop there.

On the chest of Roberts's armor was emblazoned a weird-looking monster like an octopus with the head of a shark. Hammell's armor bore a kind of big intertwined snake with large teeth. Morrissey's had a giant sea horse with a nasty look on its face, two impressively muscled scaly arms, a dagger in hand, and large sharp teeth. Only Bergen's looked like the regulation Crustaxan armor on the screen. Bergen's armor was considerably dented, blackened in places, and bore long scars and marks where the metal looked almost as if it had boiled and frozen in succession, to leave rings of beaded metal around an uneven surface.

Roberts strained his mind to try to encompass what was behind this, and failed.

"Listen," he said, "instead of this, whatever it is, what do you say you make the armor look like those things marked on it? Then we'll be aliens, and it will throw all their plans out of gear. We need a little room to improvise."

There was no answer.

Roberts shrugged, and headed for the armor. Each of these Interstellar Patrol ships had its own "symbiotic computer," and he had discovered that there was no point arguing with the things, though *sometimes* they would take suggestions.

Hammell, the same look of moody resignation on his face, started for his armor.

Before either man could reach it, three of the suits of armor—excepting only Bergen's—trundled back into the lockers. The lockers shut, and there was a rumbling noise.

The voice of the symbiotic computer said, "Not a bad idea. One moment . . . Volunteer Bergen, you may put on your armor. There will be a brief delay for the others."

Hammell looked at Roberts.

Roberts said intently, "Make sure we can move around in that armor. We don't want to get in there and be helpless."

"Don't worry. These forms are suited to combat. You will adapt to them readily."

There was another rumble, and the three lockers came open.

Roberts winced, and Hammell took a step backward. Bergen, struggling to get into his unfamiliar armor, made an abortive grab for his gun.

The armor now matched the creatures emblazoned on the front, but, in three dimensions, they were far more hideous than Roberts could have imagined.

Roberts's armor had various sizes and shapes of metal tentacles ab-

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sently coiling and uncoiling, while Hammell's came out of the locker followed by some fifteen feet of sinuous flexing metal snakelike body. Morrissey's rolled into the room on caterpillar treads, the upper part of each arm as big around as the trunk of a sizable tree.

Bergen, inside his suit, extended big claws and laughed. "I'm the only human here."

Roberts cautiously avoided the metal tentacles, walked around to the rear of his armor, and snapped open the backplate.

"No," said Hammell, looking around irritatedly, "this is too much. How do I walk inside this thing? How do I handle anything? There are no arms or legs on it. It won't work. Let's have something a little more reasonable."

"The volunteer," said the symbiotic computer placidly, "will kindly refrain from criticism. The boarding craft is approaching. The armor will be found highly satisfactory—unless you would rather go out without it."

Roberts climbed in, to find the interior looked the same as usual. He got the back plate shut, and—

—Suddenly he was flexing giant tentacles, eager to get the enemy in his grasp and snap him in half.

Roberts blinked.

The thoughts died down, but the sensation that he possessed a variety of powerful flexible limbs persisted. He could, in fact, seem to *feel* with them.

Roberts cleared his throat, and wondered if the computer would hear him.

"No offense, friend," said Roberts, "but the illusion of control of all these tentacles is likely to be hard to maintain. It might work for an octopus, but someone with just two pairs of actual limbs—"

The complacent voice replied, "One dozen pairs of limbs, Volunteer."

"How do you count—"

"The fact of ten separate individually-controlled digits is not to be dismissed merely because they are activated at the ends of another set of jointed appendages."

Roberts frowned. "O.K., *maybe.* Where are there any weapons?"

"An excellent point. While carrying out a truly creative masterpiece, the artist sometimes loses sight of mere necessities."

There was a further rumble and *clank*, and the armor was jerked back into the locker, with Roberts inside it. The door of the locker shut. A weird intense light flickered briefly. Then the door opened up again.

"Weapons," said the symbiotic computer, "will be found in the usual place—attached to the weapons belt. Now, prepare to leave with your prisoner."

"What prisoner?"

"Admiral Nade, obviously, is your prisoner."

A small voice spoke in Roberts's ear, and Roberts recognized. Nels

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Bergen, who said exasperatedly, "Does anyone understand what's going on?"

Hammell's voice, similarly small but clear, said, "All I know is, I'm inside armor that's shaped just about right for a boa constrictor that's thick through the chest. Nobody has explained anything to *me*. The funny thing is, I think I sense how to work the thing."

Roberts said, "If I can follow it correctly, the symbiotic computer wants us to act as if we've captured Nade."

"Who is *we?*" Hammell demanded. "So far as I know, there's no intelligent creature in the known universe that matches the shape of this armor."

Roberts said, "That ought to confuse the Crustaxans. I don't like the way that last message went. We want to get them off-balance."

"That's nice for a start, but where do we go from there?"

"We get the prisoners loose from the Crustaxans."

"*How?* You've skipped a few steps. What do we do *next?*"

"Don't ask me. But we've obviously got to get in that fort somehow. We'll have to see what turns up, and move fast."

"Yes, but . . . for the love of—"

"Bergen," said Roberts, taking a glance at the outside viewscreen.

"*Sir?*" said Bergen unhappily.

"Lead the way to the nearest hatch onto the outside of this hulk. That boatload of armored crabs is getting close. Let's see— They look like they're heading for the wreckage of that armored bridge in back of the main turrets."

"O.K.," said Bergen. "We can go through in back of the false wall. But we don't dare get out in the corridor, or we'll get blown up."

"Lead the way," said Roberts.

Bergen went out the aft hatch. Roberts stood back to wave Hammell and Morrissey ahead, and involuntarily jumped back as they started to move. They looked like a giant armored python followed by an armored tank with a muscular sea horse inside of it.

Roberts growled to himself, watched Hammell's armor slither up through the hatch, while Morrissey's rose up on a kind of hydraulic jack arrangement that boosted him to where the treads could get a grip. In the corridor, Hammell slid along close behind Bergen, while Morrissey bumped and rumbled along behind Hammell.

Roberts shuddered at the sight, took hold of the hatchway with half-a-dozen tentacles, vaulted through, and strolled along the corridor behind Morrissey.

The voice of the symbiotic computer spoke in Roberts's ear:

"Communications spy-pickups are now moderately well distributed throughout the spaceport itself. We are processing large numbers of official and personal messages."

"What good does that do us? Have

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you found any trace of the prisoners?"

"Two references suggest that they are in the 'tank.' We have no indication yet as to where the 'tank' is located."

"That's a real help," said Roberts dryly.

"The principal benefit, however, is an improvement of language ability. We now have many cross-checks on previously uncertain words and phrases."

Bergen said, "Watch you don't bang anything going through here." He led the way through a narrow passage lined with squat guns on tripod mounts, connected by cables with small boxes hung on the bulkheads, this passage being one that paralleled one of the main corridors of the imitation dreadnought, the

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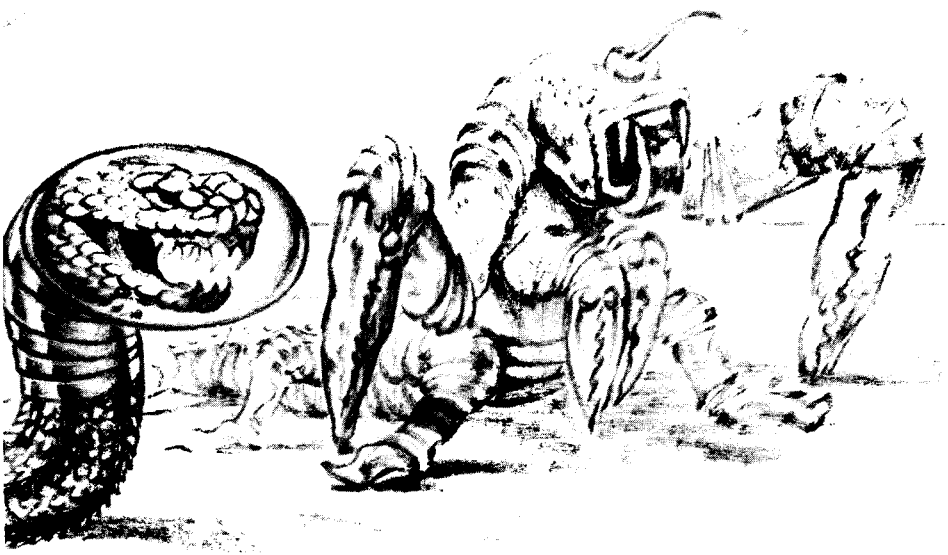

guns set to sweep the corridors after the Crustaxans were well inside the ship.

Bergen stopped. "Here we are." He undid a heavy fastener, slid a thick panel out of the way, and stood back to let Roberts, Hammell, and Morrissey go through the opening into what looked like the patched-up remains of a warship's bridge.

From somewhere came a clang, and Hammell said, "That's the outer hatch of the air lock. They're coming in."

Roberts noticed that Hammell's voice sounded clear, and as loud as usual, and realized that he was now hearing him "normally"—that is, by way of the speaker in Hammell's battle armor, which made sound vibrations in the air, and were picked up by Roberts's armor, and repro-

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duced loud and clear so that he would know he was not hearing Hammell over the communicator.

Roberts turned, in order to face the inside hatch of the air lock.

Slowly, this hatch began to open.

Roberts turned his head and used his chin to fully depress a short broad lever inside the helmet of his suit. This snapped on the armored suit's communicator, and shut off its external speaker.

"Hammell," said Roberts. "Try your communicator."

"Here," said a small voice.

"Bergen," said Roberts, "step out in front of the rest of us. We want them to see you first."

The inner air-lock door was steadily coming open. Now a set of armored claws reached in.

Bergen's small, somewhat plaintive voice said, "Now what do I do?"

The inner air-lock door swung heavily open.

Eight or nine space-armored figures, carrying long-muzzled guns, stepped in.

Hammell's small voice spoke urgently in Roberts's ear. "Listen, what's the picture? What do we *do?*"

"Just follow my lead." said Roberts, "and don't worry. The general idea, for now, is that we are a collection of aliens who have captured Arvast Nade. We're here to stick a red-hot poker into the Crustaxans. As for the prisoners, our only interest in *them* is that we'd like to have them to wring some information out of them for ourselves."

Hammell's voice said uncertainly. "O.K. Lead on."

So far, so good. But for the moment, Roberts was not sure just what to do next.

The Crustaxans, looking around, now spotted "Arvast Nade."

Roberts strained his mind for the right move to make next.

Abruptly, Roberts's voice boomed out, though his mouth was tightly shut:

"Gar trak nu clagg bar ke ia tu dek holben—"

Suddenly, Roberts began to hear it differently:

"By right of conquest. We also claim this prisoner here enslaved. You may step aboard this ship alone at our goodwill. We are masters of this great starry sea. How is it that we know not the like of you?"

Half in and half out of the air lock, the Crustaxans stood paralyzed.

Roberts's voice went on by itself, as he listened admiringly.

"We are come to split the stars between us, to say who owns here and who there. Have you no speech? Know you not the mighty of the realms of space? In your own tongue we conjure you to lead at once to your chiefs!"

The collection of frozen shapes at the air lock jarred into a semblance of disorganized motion.

Several with insignia on their spacesuits contended to thrust each other forward, and a large individual with claws like giant nutcrackers received the honor.

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"Aaah," came his reply, "we . . . eh . . . hah . . . we welcome you to *Ironclaw* Fortress with . . . ah . . . cordial feelings of fellowship. But let's not stand talking here. Let us escort you to the commander. Admiral Ialwo is eager to see your, ah, *prisoner.*"

Roberts attempted without success to unravel the undertones and innuendos of this speech. His job was made no simpler by the translation process. Where the symbiotic computer was itself uncertain how to render tone or emphasis, it gave various renderings simultaneously. The effect was like hearing a chorus of identical people simultaneously recite the same words in different tones of voice.

Roberts, however, did not hesitate. When the armor remained silent, he spoke in a loud firm voice. Now that things were moving, he aimed to keep them moving.

"We accept your cordial welcome," he said, "and we return it in the exact spirit in which you offer it." He glanced at the two armored monsters beside him.

"Let us go, gentlemen."

He then glanced sharply at the battered armor inside which was Bergen.

"You, *slave!* Move!"

Roberts's battle armor added its own bit gratuitously, tacking the words on so neatly that there was no delay between Roberts's words and its own:

"*Move*, I say! Ha, ill-formed beast, dost wish another winding on the rack?"

A kick from Roberts sent the clawed figure staggering, to land with a crash against the base of the hatch opening.

Hammell was gliding along beside Roberts, the scales of his armor against the metal underfoot making a noise like the continuous riffling of a deck of steel cards. Hammell's voice came out in a loud guffaw.

"It doth entertain me greatly to see the clumsy creature stagger. You recall the arrogance with which it entered into our presence?"

Morrissey was rolling along beside Hammell, tracks clanking.

"We must remember to give it fodder ere too many more days pass. 'Tis best to keep it alive. I misdoubt we have drained the dregs of its secret knowledge as yet. A few more turns of the screw— Who knows?"

Roberts, alarmed, watched the shifting of guns amongst the Crustaxans. One of them swung his gun toward Roberts as Roberts entered the lock. Roberts, without thinking, reached for his sword.

It occurred to him belatedly that if he drew the sword, the whole situation, already shaky enough, might come unstrung.

One of the armored suit's larger limbs, however, obeyed his impulse instantly, and whipped out the sword. There was a glittering arc in the air. The Crustaxan's gun landed on the deck in two pieces. The suit

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thrust the point of the sword into the Crustaxan's armor at the midsection. Roberts's voice spoke casually.

"A little more respect to your betters, my lad, or you have a short life in front of you. Well, do we want to spend the whole day here? What's all this?"

Hammell had one of the Crustaxans battered off his feet, and another wound up in the coils of his armor. The tail of the armor was twining and untwining menacingly. Hammell's voice was a low rumble:

"This churl did menace me."

Morrissey had one of Crustaxans upside down by one foot, and jerked its gun away with his free hand.

"This fellow tried to pry at my treads as I passed. Why not slaughter the lot?"

"Come, come," said Roberts's voice, "we are here to be friends. 'Tis the nature of a crawfish to be a crawfish, and we should be philosophic about it. For now, anyway."

Morrissey promptly dropped the Crustaxan on his head, bent his gun into a pretzel, and courteously returned it. Hammell loosened the coils of his armor, and the Crustaxan inside fell out on the deck. Roberts observed that he himself had absently taken three or four of them around the neck by various tentacles, and now let them loose after a final squeeze.

The biggest Crustaxan, by the air-lock door, stared around, hesitated, and then shut the air-lock door.

Roberts had a sense of something missing, and realized he didn't see Bergen anywhere. He looked all around.

Bergen was huddled, behind a couple of paralyzed Crustaxans, big-clawed arms over his face, his armor clanking against the air lock as he shook.

Apparently what had happened so far had induced some respect in the Crustaxans, as the transfer from the lock to the shuttle, and from the shuttle to the spaceport itself, took place without incident.

Roberts, Hammell, and Morrissey—along with Bergen, who cringed in Morrissey's grip—found themselves standing on a thing like a four-sided dock, which, with many others like it, was thrust out into the empty space enclosed by the spaceport. The dock apparently had an axial gravitic field, as work was going on all its four sides, with Crustaxans striding back and forth at angles of ninety and one hundred eighty degrees from what Roberts's instincts considered "up."

The spokesman of the party that had taken Roberts and his companions from the ship had the helmet of his armor off, and was talking in a low voice to the leader of a platoon of guards waiting on the dock. Roberts was too far away to hear what was said, but this didn't bother the battle armor, which selectively amplified the Crustaxans' murmurs, until they were louder than the shouts of laborers on the dock, *their* voices

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being moderated till they were merely sounds in the background.

"Impossible," the leader of the guards was saying. "Their Excellencies know something about that ship which you do *not* know."

"I don't doubt it," said the spokesman for the shuttle party. "But what I say is true, just the same. Don't take my word for it. Ask anyone who was out there with me."

"You seem straightforward. I'll take your word that you *think* it's so. Now, let's be sure I follow this. First, you're satisfied that isn't Nade's command ship?"

"Bah! It's anything *but*. Not only is size-scale off, but the inside of the air lock is wrong. The pressure was about right, but not quite. The bridge itself is like nothing you ever saw. Grant that it's a shambles, still."

"Be specific."

"Well, there isn't a claw rest anywhere. And the switch-stalks are all too short. You'd have to stick your pincers into the control board up to your elbow to get close enough to get your manipulators onto the switches. The read-outs are too low, and the pilot's seat is solid in back. How are you going to sit in it? At a first glance, yes, it looks plausible. But then the details hit you."

"Now, how about Nade himself?"

"I don't know about that. That armor is nonstandard design, but you can't be sure. It's got fittings in all the right places. But if that's Nade, he's sure got his claws in the mud."

"Pretty much beat down, eh?"

"He feels it coming before they hit him."

There was a peculiar grating crunching noise that came across untranslated, and then the guard leader said, "Well, we'll even up the score when we give this bunch the thin-slice treatment. You still think all these fakes are real, eh?"

"I tell you, fakes *couldn't* act this way! They come across as fake as a force-10 meteor storm!"

"They're just faking on a deeper level. But I'll bear that in mind."

The guard commander left the shuttle-party spokesman, and walked over to Roberts. He clashed his claws together.

"Honored guests, accompany me. You will be taken directly to the audience."

Hammell growled, "Your Grace, another half dozen of those shuttles are heading for our ship."

"No bother," said Roberts. "We can use some more specimens."

The guard leader paused, then bellowed a command. The guards, bristling with weapons, formed a double line along the edges of the dock. One of the guards, carrying a thing like an overgrown washtub, with the flat bottom of it turned up, raised a kind of mallet, and hit the tub a mighty blow. The top of the tub vibrated with a rhythmic *thump-thump-thump* sound. The nearest of the guards marched off in unison between the lines on the dock.

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The guard leader said sharply to Morrissey, "Stay right with me. If you fall behind, my officers may mistake it for disrespect, or even an attempt to escape, and use strong measures on you without thinking."

Morrissey promptly rotated on his treads, to look across the interior at the far side of the spaceport.

"If you will pardon me, Your Grace, I think I will admire the view for a few moments."

Hammell coiled himself into a sizable heap with a tip of armored tail sticking out the bottom.

"Ho-hum. I think I shall ease the fatigue of the day with a little snooze."

The guard commander, just briskly starting off, stopped and turned as Roberts reached out, took Bergen, who was just starting after the guard commander, and jerked him off his feet.

"My sincere and humble apologies," said Roberts dryly to the guard officer. "We could not agree to accompany you until it is understood that your officers will accommodate themselves to our pace. Otherwise, some momentary lapse of restraint on our part might lead us to unintentionally dismember your officers."

"Ah?" said the guard commander silkily. "Is that so?" He bellowed a new order.

The guards whirled, guns leveled, and approached at a run.

Morrissey reached out a tree-trunk arm, and with a loud snapping noise bent up fifteen feet of thick L-shaped angle-iron that protected the edge of the dock.

Hammell unfolded from his coil like a streak of metallic glitter, and flashed into the ranks of approaching soldiery, hitting them below knee-level. Using these numerous legs as a snake uses twigs, rocks, and blades of grass, this equivalent of a tool-steel boa constrictor flashed in and out amongst them, the soldiers thrown in all directions like logs afloat in a rapids. Morrissey, like a giant spooning soup, reached methodically into the tangled heaving mass with his length of massive angle iron, to flip members of the guard off the dock and out into the void.

Roberts, meanwhile, casually held the guard commander with a few pairs of tentacles, switching grips on him from time to time to put him on the path of any angry guard that happened momentarily to get past Hammell and Morrissey. This way, the guard commander received the blows meant for Roberts.

Quickly wearying of this, the guard commander bawled a new order.

The tumult subsided. Hammell raised up, and looked out of the tangled heaps of soldiers.

Morrissey knocked loose a few more clinging to the edges of the dock and trying to take aim at Hammell, then propped his angle-iron upright, leaned on it, and waited.

Roberts had let go of the guard

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commander, save for one long slender tentacle, like a snare made of wire, that had him by what served for a foot.

"It would be appropriate," said Roberts judiciously, "since your armed strength is so inferior to ours, to avoid any action which we might mistakenly interpret as a discourtesy. Should we come to feel that there has been any serious provocation, we might find it necessary to wipe out the stain by dismantling the whole installation."

The guard commander was apparently making efforts to speak, and finally achieved it.

"I – You – We will adjust the rate of march to . . . to avoid any difficulty with the officers."

"Proceed," said Roberts, cheerfully.

The commander bellowed orders.

The guards, breastplates dented, weapons bent, many of the guards nursing injured limbs, fell in in two long lines.

With Roberts, Hammell, and Morrissey setting the pace, they headed for the audience.

The audience chamber proved to be a huge room, the near end was a blank wall, and the far end another blank wall. Roberts had the impression he was standing on the bottom of a giant's empty swimming pool. From a heavily glassed-in platform overhead, a creature well equipped with large claws and pincers looked down, holding a microphone in a set of comparatively small appendages at its chest.

"Pleasant greetings," purred the creature's amplified voice. "It is certainly a rare treat to have helpless victims present themselves as you have, both incapable of sustained resistance and yet sufficiently arrogant to add zest to the situation. Allow me to acquaint you with my identity. I am Gratz Ialwo—formerly Garvast Nade—Commander of Fortress *Ironclaw.*"

Roberts silently digested the fact that, with one sponsor finished off, a promising Crustaxan might get another sponsor.

"I," said Roberts, "shall return the favor, and acquaint you with *my* identity. I am Rasgaard Seraak, Adjunct-Coordinate to the Empire, Galactic East."

That sounded good to Roberts. What it meant, he didn't know, but that was Ialwo's problem, not his.

"Uh—" came Ialwo's voice after a pause. "And your companions?"

"I," said Hammell, offhandedly, "am Prince Gdazzrik of the March."

"And I," growled Morrissey, "am known as Sarkonnian the Second, Lord Auxiliary of the Realm to the West."

There followed a further silence. Ialwo, when he did speak, sounded somewhat hesitant.

"And the other individual, who accompanies you?"

"His identity," said Roberts, trying to unravel the significance of the peculiar sound of Ialwo's voice, "must

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remain for the moment undisclosed."

"There has been a suggestion that he is in reality Arvast Nade, Admiral of Crustax."

"I am," said Roberts candidly, "aware of the suggestion."

"You are also aware that you are in a hopeless position."

Roberts had been looking over the walls of the place as he talked, noting that they were apparently metal, with a number of small openings high up, below which were long, nearly-vertical, brownish stains. The door that had shut behind them had fit into the wall in such a way as to leave no visible trace. Knowing the strength of the battle armor, Roberts was not prepared to say they were helpless; but he was inclined to think they would have some trouble getting out of here.

Roberts laughed, as if he had just heard an unusually funny joke. The armor eliminated some little imperfections in the laugh, which boomed around the smooth-walled chamber as a explosion of rare good humor.

Hammell and Morrissey chortled appreciatively.

Bergen trembled all over.

Ialwo's voice murmured, "So, this is the sound our interrogators identify as meaning 'entertainment, skepticism, or good cheer'? We'll adjust *that* attitude."

Abruptly there was a hiss.

From one of the holes high up across the room, a liquid jet reached out and arced toward the floor, but flashed into vapor before it hit.

Ialwo said pleasantly, "One of the most difficult engineering feats is the disposal of excess heat. The answer, nearly always, is to somehow conduct it to the external environment. But—when the external environment is itself far hotter than the . . . say . . . armored suit which needs to be cooled . . . what then, eh?"

There was another hiss, and a further spurt of sizzling vapor, this time from another hole.

Roberts considered the situation. Possibly the best solution was to take a shot at Ialwo, then see if he could cut his way out of this place. But—could he cut through fast enough?

Roberts relaxed. The armor made his casual reply even more cool and unconcerned. "Such an attempt would constitute a serious provocation. A person in an inferior position might well think carefully before venturing such a provocation."

"And in what way do you punish a provocation when the provocation succeeds in creating your demise?"

"Very easily, if serious preparations have been made beforehand."

"You will not escape this room. Whatever powers you may possess, the walls of this tank constitute an obstacle which will require a measurable pause for you to get through. *That is all that is necessary.* Your first motion at attempted escape will result in an instantaneous molten discharge that will cook you inside your armor. Again I ask: 'In what way do

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you punish a provocation when the provocation succeeds in creating your demise?' "

There was a tone of barely suppressed jubilation in Ialwo's voice that Roberts didn't care for. However, he still had the possibility of creating unease in Ialwo's mind, since Ialwo's information came from prisoners thoroughly convinced of the reality of one of Roberts's earlier masquerades.

"I will tell you a story," said Roberts, his voice calm and unconcerned, "and at the end of this story, you will not only release us from this chamber unharmed—something which you will do anyway, as you have no choice—but you will also find a suitable way to make amends. *The Empire looks after its own, and does not treat such insults lightly.*"

There was a lengthy pause. A lack-of-breath sound was back in Ialwo's voice when he spoke.

"What Empire do you speak of?" Ialwo demanded.

"*The* Empire."

"Uh—" said Ialwo. "This . . . ah . . . is some governmental organization allied with Earth?"

"Earth," said Roberts, "acts on a basis of relatively short-range profit and loss. The Empire arranges its accounts somewhat differently, on a more long-range basis."

"Crustax," said Ialwo cautiously, "has had no formal contact with the Empire of which you speak. We have heard only *rumors*. Rumors prove nothing."

"Each and every Citizen of the Empire," said Roberts, "may rely—if his conduct be good, and his pursuits proper—upon each and every other Citizen of the Empire for protection against outsiders. In fact, the provision of such protection by one who is not a Citizen is often sufficient to move His Majesty to grant Citizenship to mere allies and associates—a boon for which many crave, and which is hard to gain."

There was a prolonged silence, during which Roberts seemed to hear Ialwo thinking.

"And," Ialwo said craftily, "if the rescue attempt *fails*?"

Roberts groped for an answer to the question, and with his mouth still shut heard his voice answer cheerfully:

"Why, all depends upon the manner of such a failure. There is failure, and then again failure. If failure ends in base cowardice, what is there to say? That is disgrace. But if it ends in glorious searing of a more powerful foe, and even if its failure doth rock him on his throne, perhaps cast him down into disorder and ruin—why, there is vengeance, if not success. 'Tis then a glorious failure. If known, it will be sung by the minstrels to the King himself. If unknown, yet it will be recorded on the Great Books, and seen aloft in Heaven. What is done cannot be undone, and glory once gained, though it rust on Earth, is immutable in the Great Records of Time. It is far best to succeed, but Honor may require—

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even unsure of success—that the attempt be made."

There followed a very lengthy delay, then Ialwo murmured, "This proves nothing at all. And *yet*—" He paused. "Let us hear this story you were going to tell."

"Once," said Roberts coolly, calculating how to mix the large quantities of fabrications in with the very slender whiff of truth, "there was a leader of a mighty power allied with a still mightier Empire. All that was needed to make the happiness of the leader complete was to possess Citizenship in the great Empire. But this Citizenship was hard to achieve, particularly since the leader was of a completely different race from that of the Empire. It could only be won by proof of valor and craft in a good cause, in service of the mighty Empire. Much time passed, and then the opportunity presented itself. Another power seized certain Citizens of the Empire, and held them against their will.

"The mighty leader selected two hardy friends, disguised his most dread warship as a liner of Earth, and disguised the liner of Earth as a ruined alien hulk . . ."

Ialwo sucked his breath in—suggesting that Interstellar Patrol camouflage was better than Crustaxan detectors.

". . . And," Roberts went on, "journeyed to the space fortress where the Citizens were imprisoned. Once there, he was admitted by the crafty governor, and taken ashore along with his friends, and a robot packed solid with *Ultrax* instantaneous fulminating-gas explosive, to a large audience chamber. Here, the governor menaced him, and the mighty leader set the robot to explode at the first sign of hot metal which the governor threatened to pour in. The pressure generated by the explosive would, of course, shove the hot metal back in its passages, and probably blow the roof off the audience chamber.

"Meanwhile, the warship in the spaceport of the fortress had taken note of the defenses, and was now prepared to raze the interior with its powerful guns. Outside, at a distance, a fleet of the leader's warships stood by, to inflict retribution if the leader should be harmed. Attacked inside and out, with the landing force already within its gates, the situation for the fortress commander did not suggest the likelihood of victory.

"That," concluded Roberts, "is the story. And now I suggest that you consider it carefully."

There was a faint tremor underfoot, and the governor murmured, "That *is* a warship. Well, well. Now *I* will tell *you* a story." He gave a low grinding popping noise that the suit tentatively translated as a laugh. "Once there was a young survivor of Crustaxan seas, who entered into adulthood with high promise, was chosen as the successor of a great leader of high position, and suc-

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ceeded to command of a mighty fortress. His future seemed to glitter before him. Then Earthmen destroyed the great leader, brought him down in disaster. His successor was forced to abandon the name, covered with dishonor, and enter into a much lesser succession. Meanwhile, some captives being squeezed for information exuded a story about an Empire that no one knew to exist, and stuck to this impossible story until three equally impossible Earthmen disguised as monsters turned up at the space fortress, and were entrapped inside, along with their camouflaged warship, which floated in the spaceport under the far mightier camouflaged interior guns of the fortress. At this point, the impossible monsters, trapped in a heat-treatment room, repeated the same impossible Empire story, leading the governor of the fortress to see the connection between the two, and recognize the story as a clever posthypnotic sidetrack to mislead interrogators seeking admissions under torture. Very clever. But now the governor could see the way to great honors by capturing the warship of the Earthmen, regardless of the price, and the Earthmen themselves, dead or alive, because after what happened at Storehouse, *the leaders of Crustax will delight in such a victory over Earthmen.*

"How," Ialwo concluded gloatingly, "do you like *that* story?"

"Somewhat boring," said Roberts uneasily. The battle armor strained the uneasiness out of his voice, and added, "A clumsy warrior thrusts too soon, revealing to his opponent his weak point, whereupon he must pay the penalty."

"Meaning what?" said Ialwo sharply.

Since Roberts didn't know, he was relieved to hear the armor answer coolly:

"Meaning that what you cannot bear is further disgrace. *Personal* disgrace, Ialwo. Disgrace that you must *live* with indefinitely, or else destroy yourself."

"The possibility of such disgrace does not exist in this situation. Combat, yes! But that is honorable. Disgrace? *No!*"

Somewhere, there was an odd grating grinding noise, like a set of drills and scrapers busily at work.

Roberts still didn't see the outcome, but his voice was cheerfully insinuating:

"And suppose you are associated with a worse disaster than your former sponsor, Admiral Nade? What then?"

There was a final scrape-*grind* noise, and a small dully-glinting thing popped into view, and ran ratlike along the base of the wall to the far end. There it huddled in the corner and quivered and shook as new grating, grinding noises accompanied the accumulation of a pile of metal shavings.

Roberts looked on blankly.

There followed a sound as of a

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thick wad of metallic cloth shoved through a small opening, and a second thing just like the first popped into view, to scuttle along the base of the wall and join the first one.

Ialwo murmured, "What kind of a thing—?"

Roberts's brain sluggishly added up the facts: *He* had never seen anything like that. Ialwo had never seen anything like that. But who else was involved in this collision? Only the symbiotic computer. But the hole the thing made was too small to help. Wait, now. Suppose—

Roberts was still working it out as his voice said, "Watch it closely, Ialwo. Dozens of such things are loose in the fortress. As they reproduce quickly, soon there will be thousands—unless you can persuade *us* to take them with us when we leave."

"But what *are* they?"

"Just a development of a thing called a *rat*, which is a pest amongst the humans. This variety is a result of much development. It utilizes iron in its metabolism, in a form which makes it exceedingly tough, hard to kill, and capable of gnawing through almost any barrier. What it is after, of course, is your stores, reserves, food stocks, though it can live for some time, if need be, on spaceship fuel—such as doesn't leak out after it gnaws through the tanks. It is a very dirty creature, and—"

"Spaceship fuel," muttered Ialow. "Stores, reserves, and food stocks!"

"At this moment, the things are eating and reproducing all over the fortress. All they do is eat and reproduce. Except, of course, to—"

"Hold your explosion!" roared Ialwo. "This is not aimed at you!"

A white-hot stream poured down from a hole high up, at the far end of the chamber. It landed away from the corner. The creatures there gnawed frantically. There was a second, much briefer dazzling spurt, with less pressure behind it. It fell too far out, but spattered the corner.

There was a desperate squeal, and one of the ratlike creatures tore around the floor, jumping into the air, twisting backwards, and biting at its glittering fur. The other, however, suddenly popped out of sight, leaving a single hole behind it. The first ran, humping itself desperately, along the base of the wall toward the place from where it had come in, then suddenly reversed itself and popped out—amidst streams of glowing metal—through the new hole.

Behind it, others began to come in through the original hole. These ran, humping and scuttling, with momentary unpredictable pauses, along the base of the wall and vanished out the fresh hole at the far end.

Ialwo cursed, and urgent spurts of flowing molten metal rained down, to miss them completely.

In the silence that followed, Roberts said. "They are not easy for a nonexpert to kill. Much skill and know-how is required."

Ialwo's voice sounded suddenly sober.

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"How did these things get *in* here?"

"No problem in that," said Roberts's voice, matter-of-factly. "They are adept at concealing themselves. You have sent a number of your shuttles out to the ship. That's all it takes. They, for that matter, could easily throw themselves across the gap from ship to docks. One good shove, and they will drift the rest of the way."

Ialwo didn't say anything.

Roberts's voice was almost regretful.

"You can imagine how these things will spread, what damage they will cause, and what honor will be heaped on whoever is considered responsible for letting them get started. You do understand who will get all the credit for the trouble these things will cause, don't you, *unless* you can persuade us to get rid of them for you? Bear in mind that they are reproducing while you think."

Ialwo's voice came out in a croak: "What do you want?"

The camouflaged battleship was well on its way back, with the rescued prisoners recuperating in deep sleep, when Hammell said wonderingly, "Who would have believed it? He was ready enough to fight a war—that didn't bother him—but *rats* were too much."

Roberts said thoughtfully, "The effect of a blow depends not only on how hard it hits, but on where it hits, and how unexpectedly. He was a fortress commander, and all set for a fight. But the rats hit him on the raw nerve ends, *unexpectedly*. He couldn't gather from questioning us that anything like that was coming, since we didn't know it ourselves. The symbiotic computer cooked that one up all on its own."

Morrissey smiled. "*There's* deception for you! The Crustaxans are pretty good at it. But how do they compete with that?"

"Two heads," agreed Roberts cheerfully, "are better than one. Even if one *is* a symbiotic computer." ■

The Analytical Laboratory / October 1971

PLACE	TITLE	AUTHOR	POINTS
1	Hierarchies (Pt. 1)	*John T. Phillifent*	1.59
2	The Golden Halls of Hell	*John Paul Henry*	2.77
3	Motion Day at the Courthouse	*Ted Thomas*	3.40
4	The Crier of Crystal	*Joseph Green*	3.81
5	Mr. Winthrop Projects	*Tak Hallus*	4.28
6	Moon Spore	*G. I. Morrison*	4.76

THE EDITOR

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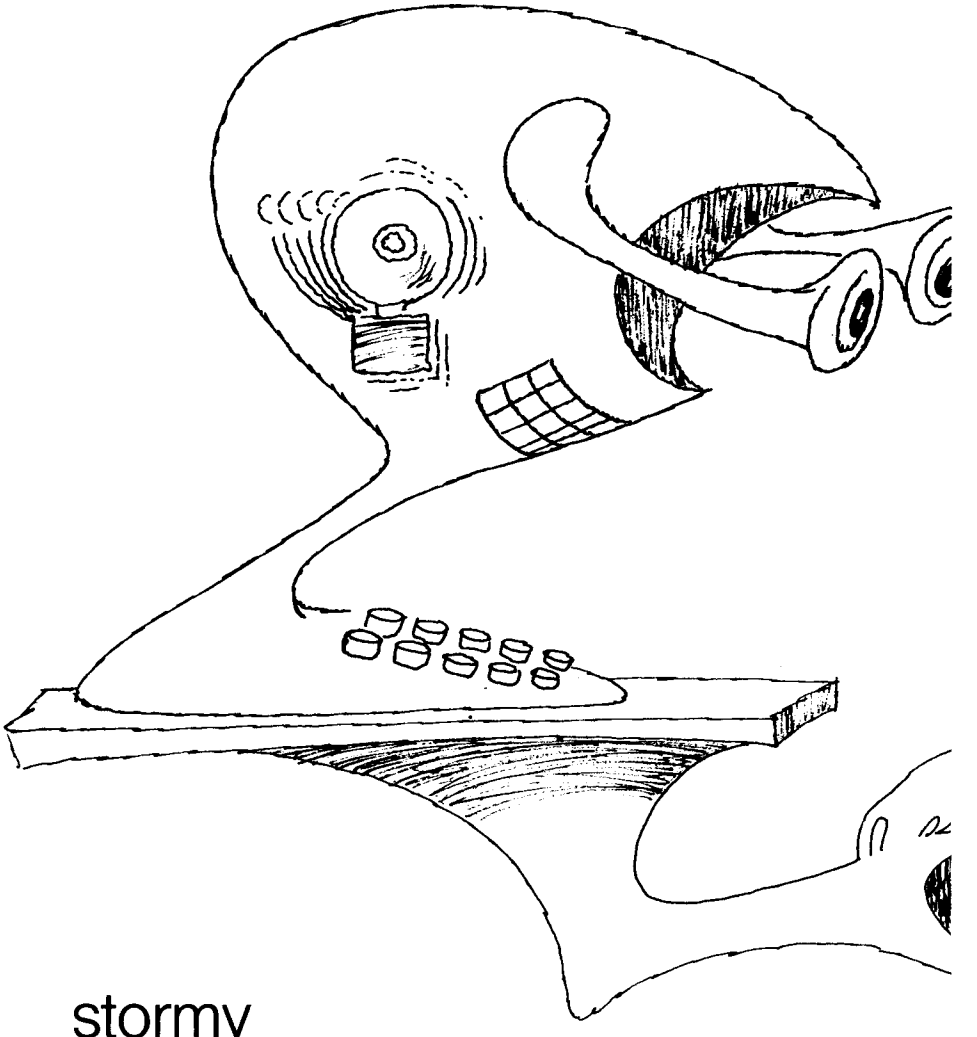

stormy bellwether

The business of science fiction is to explore
the probable consequences of introducing new technical devices.
For instance now, let's consider the vuphone . . .

JACK WODHAMS

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"I don't care if it is a status symbol, I don't want one in my home."

"It's not just a status symbol," his wife countered firmly. "It is very useful and has a lot of desirable features."

"What desirable features?" Birk asked. "What the devil do you want to see for? It was bad enough before, being obliged to answer and listen. All it is is an extension to invite a greater invasion of our privacy."

"Really, Birk, you do make a fuss," she complained. "What's so exceptional in speaking face-to-face? It's the normal way, isn't it? We're doing it all the time. We're used to it. *I* like to see who I'm talking to."

"Oh, yes," he granted, "there are times when it might be nice to see the person at the other end—but that's not most of the time. I don't want to have to look at any Tom, Dick or Martha who may wish to draw solace from my harassed features. Not at home, Lena! A man should at least be able to relax in his own house."

She wriggled a little. "So how will it stop you from relaxing?" She sounded a trifle cross now. "You're being juvenile, Birk. You're behaving like they did when telephones first came in, an old-fashioned type who thought they might explode or something. For heaven's sake, it's only talking to somebody—surely you can handle that?"

"You don't understand, Lena," he tried to keep patient, but the effort was evident. "It's the getting no choice. *Anybody* can come right in here and see me whether I want them to or not. I close the connection and I'm trapped."

"You're exaggerating it out of all proportion." She clasped her hands in front of her. "You're meeting people every day, in the street, in shops, in business. You don't get excited then, do you? I can't understand you, Birk. Everybody's getting them put in, for their convenience and obvious advantages. You have to keep up with the times, and nearly all the people we know are getting them, or have got them already."

"I don't care about that!" he cried. "*I* don't want one. I don't want one in my house."

Lena became irritable. "Well, we've got them. And before you start thinking to get them thrown out, you'd better see what your boss, Mr. Flodrankle, has to say. He likes his employees to be ambitious, and he even helped us to get priority."

"Huh? Old Flo? Why—" Birk knew revelation. "So *that* was the cozy get-together at Cooky's retirement party. You fixed it then."

"I wanted it to be a surprise. I thought you'd be pleased." Her stubborn chin trembled. "I didn't think it would upset you and make you start shouting at me."

"No? Well, I—" Then with the sure instinct of an accustomed loser, he read the signs and felt his resolution crumble. Lena crying he might cope with—but with Old Flo brought in—Yes, Old Flo would want to

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know why his forward-looking executive should want to reject such a happy favor. Damn!

At that moment there began an imperative ringing.

"You answer it."

"No, you answer it."

"No, you. You've got to get used to it. It's just childish to be afraid."

"I'm not afraid. But it was your idea, so you can get on with it. Unless *you're* frightened who it might be."

"Oh, don't be ridiculous. I've already used it a few times, before you came home. And what on earth is there to be frightened of? Are you scared someone might jump out at you?"

"I've used them too, at work," he said shortly. "It's just that I'd like to have some assurance of peace in my own house. I'd like to feel free from being gawked at behind my own front door."

Lena gave an exasperated snort and moved to terminate the summons of the bell. "I think you're being very silly about the whole business. In a few weeks," she prophesied, "you'll wonder how we ever did without it."

"Hah!" he jeered. But his heart wasn't in it.

Lena paused to fluff her hair in the mirror, to smooth an eyebrow with a finger. Quick check that everything was O.K., a smile to herself, just so, held, and she felt ready to switch on the vuphone.

"Hello?" and as the picture firmed, "Why, Mabel, darling! How good of you to call. How did you know that we . . . ? Oh, Iris told you, did she? Yes, we had them put in today. Yes, we have two, the portable one's upstairs. Yes. It's the only way. And where are *you* calling from, Mabel? From the . . . ? Oh, I *thought* I could hear traffic. Yes, the soundproofing leaves much to be desired. Still, it *looks* cozy enough in there—even if it is cramped.

"And when are you getting yours put in? What? Is he? What a terrible nuisance for you." Lena's smile became even more pleasant. "It's too bad having to have to dash down town every time you want to say a few words to your friends. Still, they're opening more public booths in the suburbs all the time, so I hear. Yes, I know dear, I understand perfectly. Some husbands are like that and make the biggest excuse out of what really is the most modest expense. Mabel, you have my entire sympathy, believe me. But, my dear, I must ask—is that a new hat you're wearing? I don't seem to remem . . . It is? I thought so. Darling, it *does* suit you, it really does. It sets off your eyes quite . . ."

And so on, and so on. Birk groaned. He recognized defeat when he saw it.

Birk was having a shower when Lena popped her head around the door. "There's a call for you," she said sweetly.

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"Huh?" He hardly broke the rhythm of his soaping. "I can't come now. Tell them to call back."

"It's Mr. Flodrankle," she was pleased to persist. "He wants to speak to you urgently."

"Old Flo?" This froze him in midlather. "Blast! Why can't he . . . Oh hell." Forgetfully, Birk cut the water, grabbed a towel and marched out.

Not until he was almost there did Birk remember that the old handset had been replaced by a vuphone. In one instant he glimpsed his boss's peering face, had flash recall, and had skipped numbly aside in unthinking reflex.

"Ocksen?" Flodrankle barked. "Is that you? Are you there?"

Birk pressed himself against the wall, out of the line of vision, he hoped. He clutched his towel and swore.

"Ocksen, where are you? Lena? Where have you got to? What's taking you so long? I haven't got all day," Flodrankle grumbled.

Birk risked a careful peek. Chest and head on screen, Flodrankle looked to be becoming fretful, bobbing, his eyes seeking in every corner available to him. "Ocksen? Lena?" Flodrankle looked at his watch, picked up a paper, pretended to absorbedly study it, only to shortly give it away to scowl at the screen once more. "What the devil's keeping the man?"

Birk wanted to race, to get dressed, dry. He gazed around in appeal for Lena, but she had disappeared. He had no time. He cursed mightily.

"Ocksen!" It was a bawl for attention, an authoritative demand from one who was unused to delay.

Birk had to answer. He cleared his throat. "Yes, sir?"

"Ocksen?" Flodrankle squinted. "Is that you, Ocksen? Are you there?"

"Yes, sir. This is Ocksen, sir."

"Yes? Where the hell are you, man—hiding under the table?"

"No, sir. I . . . I'm, . . . I'm just around the corner, sir."

"Around the corner? Ocksen, what are you playing at? Come out where I can see you. I am not," he darkly hinted, "fond of such funny games."

"Uh . . . I can't, sir."

"Can't? What do you mean, 'can't'? Are you tied to a chair?"

"No sir, nothing like that. It's . . . Ah, well, you see, sir, it's . . . It was like this—I was having a shower when you called."

"A shower?" Flodrankle was puzzled. "What's that got to do with it? I've often been called from the tub. What's the matter with you, Ocksen?"

"It's . . . I—"

"Great heavens, man, don't tell me that you're bashful? Vera's not here, and *I* don't give a hoot. I've been in more locker rooms than enough. It makes no difference to me." Flodrankle very audibly thumped his desk. "Enough of this nonsense, Ocksen, and come out where I can see you."

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Birk hesitated. He wished now that he had been bold in the beginning. It was too late to be bold now. He fumed under his breath. With a last vain look about for clothing, curtains, anything, he surrendered to the inevitable and stepped forth with what careless dignity he could muster.

"He laughed. He thought it was a great joke."

"Well, so long as he was amused, why should you worry?" Lena said, calmly.

"You don't know what it felt like standing there soaking wet getting cold, and him blathering on as though he had nothing better to do. I felt utterly foolish. It wouldn't have happened with the old telephone."

"Don't start that again. You're not up to date, that's all." She smiled grimly. "You haven't been paying attention. You have to adapt, or perish. You just haven't got yourself organized."

"Oh, yes? What am I to do, wear tie and tails all the time in case there's a call? I'll brush my teeth every half hour, shall I? And get my own makeup kit to go beside yours—just so that I can be sure to look nice if anyone rings."

"It is a new medium," Lena responded staidly. "It's only common sense to take elementary precautions." She forestalled him, "How long does it take to run a comb through your hair, to slip on a jacket and cravat? Kept handy by the voop, how much trouble is that to go to?"

"Too damn much."

"Less than half a minute," she corrected, not in the least to be daunted. "Fresh and nice, and nobody need know any different."

"I . . . don't . . . want," he reiterated tautly, "to be forced to have to fix myself up every time I answer the phone. I don't want to have to pat my curls and dance about with a silly smirk on my face for the benefit of some other grinning got-up gig on the other end. I don't want to have to bother with what I look like."

"Well, don't then," she snapped, fraying off. "Just be a slob, wear a dirty singlet. If you don't care to provide some tiny preparation so that you can always make yourself presentable, then that's your affair. I'm not going to be your nursemaid. If you don't mind people seeing you as a whiskery hobo, then that's all right by me."

"It's an imposition," he bit back. "I'm entitled to dress how I like in my own home, to be at ease in my own home, to not have to jump to spruce myself every time that damn new phone rings."

"All right, then, all right, all right, *don't*," she yelped. "Do what you like, wear a towel, then, if you think it suits you. If you want to be a disgrace, I won't stop you . . ."

It was just after 1:00 a.m. "Come on," Lena urged, to the rear and applying lipstick in case it was someone

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for her, "answer it and see who it is."

Birk tugged his polo-necked ski sweater over his head to successfully swallow his pajamas. "I'm going as fast as I can," he gritted. He picked up his brush from the voop-tray and scooped his spiky locks into reasonably smooth order. He shrugged, finished with a hand-wipe, and satisfied himself in the mirror that he had the attributes necessary to portray cool aplomb.

He stepped close to be sure that only the top half of him would show, and switched on the vuphone. "Yes?" he inquired calmly. "What is it?"

From her position behind the screen Lena could make not head nor tail of the reply. She adjusted her own cardigan, making faces at him in mouthing silently, "Who is it?"

Birk beamed. "That's quite all right," he said. "Don't mention it. It happens to us all. Goodnight." And he switched off.

Lena stopped in surprise. "Who was it?"

Savagely Birk started to remove his emergency sweater. "It was a wrong number," he snarled.

"Good morning, madam—and may I say how well turned-out you are this morning?"

"Why . . . why, thank you." Lena was flattered. "There is something you require, Mr. er . . . ?"

"Gyborne's the name, madam, and I'm not sure but what this call of mine will be wasted, as far as you're concerned, madam. No offense, and begging your pardon, but you seem a natural on the vuphone, madam. You're an old hand, you've had a lot of practice elsewhere, I dare say."

"Well . . . no. We've only had it in for a few days."

"What?" There was incredulity in his tone. "You must do television work, then, or parts in films. You're used to being on camera, that's obvious."

"Why no, I . . . I've never done anything like that. I'm, well, I'm just an ordinary housewife."

"Believe me, you're not ordinary," Gyborne told her. "You must have a natural flair in front of a lens. Yes, you're photogenic, no doubt about that."

"Do you think so?"

"You must be, you're so confident. See, a lot of women get these vuphones and they get jittery. For the very bad cases I have to recommend tranquilizers, but for most others the voop-ball is sufficient."

"Voop-ball?"

"It's a tension easer. Out of sight under the table, you can work your toes and ankles on it—very good for the calves, too."

Lena wriggled her fingers together. "That sounds interesting."

"They're only eight twenty-five," the man said airily. "I could get one delivered to you this afternoon. It's a special this month. Of course, our best selling item is our new mobile voop-bar, with glad-eye mirror and accessories. But what you *would*

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like." Gyborne tacked in skillful instinct from infertile ground, "is an auramatic lighting frame that can be simply attuned to light *your* vuphone image—softly and gently light your face in a *professional* manner.

"Madam, if I may say so, letting any old light fall any old how upon a face such as yours is not doing justice to your cheekbones, or to that burnished tint that must be in your hair. This isn't being fair to the people who view you."

Lena put a hand to her ear. "I . . . I hadn't thought of that."

"You want to be seen literally in the best light possible, don't you?" Gyborne inquired persuasively. "Lighting that blends and subtly accents your warm eyes, your firm but kind chin, your—"

"You don't know me, Mr. Ocksen," the sad man said, "but I had a fall and broke an arm and a leg, and it never mended properly. I lost my job and I got no insurance. I've got a wife and five kids, Mr. Ocksen, trying to live on Welfare, trying to live decently. It's hopeless. Two days ago we got evicted from our place. Rent was too high, Mr. Ocksen—how could I pay? Wife and five kids, we're on the street."

Birk got over his bewilderment to break into the flat monologue. "But what's that got to do with me? Why call me? I don't know you from Adam."

"No," the stranger admitted gloomily, "and you don't care. You can afford a fancy new vuphone, while I couldn't even rent one of the old ones for a week."

"Yes, maybe so," Birk said, "but why tell me? Why pick on me?"

"I got to tell somebody." The man presented a lugubrious drooping portrait. "I got to try and reach somebody. I don't know where to turn to next."

"Maybe not," Birk's hand moved, "but I'm not your man. *I* can't do anything for you."

"That's right," the man nodded in sunken fatalism, "switch off. Just forget. Just pretend I don't exist. It's easy for you. You've got a comfortable home, nice chairs to sit in, a fire to keep you warm." He stood, a pathetic martyr to indifference. "Just for somebody to care, just a little. Just to know that someone . . . someone has a heart, will listen, will spare just a couple of minutes."

One tear welled and rolled. "It doesn't seem much to ask . . . one human in despair . . . needing—" the forlorn head shook, the sleeve of his ill-fitting jacket was brought to wipe a cheek, "only a little sympathy, some understanding. I— I—" the man's hands had no strength to do more than make tiny circles at his sides, "I'm at the end of my rope. I don't know where to turn. I can't get any more groceries till the bills are paid, and . . . and—"

The man swallowed painfully. "Go ahead. I'm nothing to you. Just . . . just switch off. Just put us out of your mind. I'm sorry for bothering

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you. A few dollars could tide us over, but what's that to you? Go ahead. I took a gamble with my last dime, but," he sagged in weary dejection, "it seems I'm . . . doomed to lose."

"Now wait a minute," Birk said, "things— It can't be as bad as all that—" And maddeningly hooked, helplessly he got himself trapped.

"Brought to your very home, madam, this sale of exclusively tailored day- and sports-wear by Lorette is being conducted right *now* in our city store. Now here"—the scene cut to a stiff-faced model contorting extremely to demonstrate the elasticity of the garment, or something —"is Roberta in a simple but stylish playsuit in crimptex. Note the double-slash in the bosom and the scalloped back when the bolero is removed. This ensemble has been reduced from a projected $23.00 to a low $15.95, and is available in all fractional sizes, and custom-dyed to your own requirements. This is a genuine bargain for those who wisely are preparing for summer. The outfit lends itself very well to personal trimming, additions and accessories.

"Next we have Belinda in this stunning cross-cut beach-shift—"

Lena was fascinated.

"Why, er, hello," Birk said. "Um, you must be wanting Lena, I guess, but, ah, she's out right now. She won't be back for another hour. Could I, uh—?"

The luscious redhead twinkled at him from the vuphone screen. "No, it's you I wanted to speak to." She looked him over. "You look very nice." Her robe slipped as she crossed her legs; she didn't seem to notice. "My name is Susanah, and I live in apartment 11-D in the Laminex Building, you know it? It's not far. Why don't you come over and see me sometime?"

"Me? Why, I, uh—"

"You can make an appointment any time," she suggested. "I'll always be glad to see you. All you need bring is twenty dollars and your smile." She winked. "Why don't you write down my number? It's 59-06-38 . . ."

"I, uh—"

"Susanah, 11-D. Don't you have a pen?"

"Hm-m-m? Oh. Oh sure, yes."

"Good. Have you got it down? 59-06-38 . . ."

"Uh," Birk scribbled, "yes."

"Great." She leaned forward to blow him a kiss. "You look awfully yummy. Don't hesitate to call—"

"I tried to get through to you twice this morning, and again in the afternoon. Were you talking to people all day?"

"It's not I," Lena protested. "All sorts of people call up during the day. I don't ask them, they just do."

"And do you have to listen to them?" Birk growled.

"Some of them are very interesting," she said defensively.

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"They're just TV commercials on a private line," Birk declared. "We didn't get anything like this with the old phone. It's like I said in the first place, it's an invasion of privacy. There ought to be a law against it, but how can they stop it? All you've got to have is enough willpower to hang up."

"I don't see that it's all that bad," Lena said. "The people are always nice, and the things they talk about are always up to date. They keep a person informed. And it's not as if we *have* to buy anything—in fact I rarely do. It's a service and a real convenience."

"And I share the bill, oh yes, ha-ha. And how about the house, huh? In front of the viewer it's spotless, and here you are done up like Duchess Spunregal waiting to perform just as soon as the bell rings. You're waiting for your curtain call even at breakfast. How can you get any work done if you're going to wear a tiara all day?"

"I manage," she replied sharply. "You don't want people to think you're married to a mess, do you? How would you like Mr. Flodrankle to call and see me all scraggly with suds up to my elbows? What would he think?"

"He might think you were a sensible housewife instead of some bit player for a ballroom scene just come from dressing room 99." And as she pouted, "Those half dozen colored light bulbs that cost me fifty-five bucks don't turn you into a Ross or a Redgrave, you know. The make-believe is all yours."

She was needled. "Is it? What about you? Who paid extra to have the monitor fitted?"

"It's a checking device that I thought might help."

"Yes? Oh, yes. So who always presents his left-quarter profile now, and makes sure the combination is set to make him look tanned and show up his white teeth?" And as he sparked to warm, "And who was it got suckered for twenty-five dollars by a no-hoper bum, hey? Why didn't *you* hang up on that? He saw you coming. I suppose he made you feel like the Ford Foundation for a minute. Acting like a playboy tycoon, I suppose you thought you couldn't do anything else."

"I felt sorry for him."

"I can believe it. He's probably worth more than any ten of us put together. Birk, it's not as if we don't have enough bills of our own, you're always complaining."

"All right, it was a mistake. I thought it was the least I could do. It was too late afterwards."

"You could have stopped the check," she pointed out reasonably.

"Yes," he averted his eyes, "but he would only have called up again. I gave my word. Look, what's done is done. I'll know better next time." His jaw set. "The thing is right now. I've had enough of this business. It's intruding too much into our daily lives. It's a disruptive element. It has to go."

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"Oh, has it? And what about *my* opinion? Don't I get a say in the matter? It stays," she said obstinately. "You're not stuck at home all day like I am. It makes a lot of difference meeting people, actually seeing them live, face to face. It makes me feel part of things."

"Well, it doesn't make *me* feel part of things," Birk said, "especially when I can't even get a simple call through to my own home because the line is engaged by appliance retailers. God help us come election. The old phone was less subject to abuse, and was an *efficient* means of communication."

"And so is this," Lena averred stoutly. "For a woman this is better, she can see who she's dealing with. I'm the one who has to use it mostly," she argued, "and I like it, and I want it, and I say we're keeping it. And don't try to call home tomorrow afternoon," she warned, "because I've joined the voop Scrabble club, and I've got a game scheduled for one o'clock—"

"Please take a seat, Mr. Ocksen. That's it. Good. Now then, what can we do for you?"

"It's my wife," Birk said.

"Ah." Mr. Mortlake of the G.S. Mortlake Inquiry Service was immediately the sad, but wise, old sage with vast experience of receipt of such confidence. "Misbehaving herself, eh? Tut-tut. What are the grounds for your suspicions? Do you know who the other man is? How long do you think it's been going on? Is it a conclusion you've reached from your own observations, or do you already have some supportive evidence from independent witnesses?"

"What, what?" Birk was taken aback. "My wife? Misbehaving herself? No, I don't think so. Not that I know of, at least, not in the way I think you mean."

"Ah," Mortlake said again. His shrewd deductive powers could visibly be seen to move into action as he received this negative response. "She's not, eh? Not that you know of. But you suspect, do you?"

"Suspect? Suspect what?"

"That she might be thinking of going off with another man."

"Lena? Good grief, I don't think so. She's not thinking of something like that, I don't think."

"Hm-m-m. I see." Mortlake frowned to evidence his sobriety. "So you would like us to arrange something perhaps, eh?"

Birk was nonplussed. "Look, I don't know what you're talking about. I don't want you to arrange anything. All I want you to do is advise me how I might get rid of my vuphone."

"Ah." This was a clue to cue a glimmer of understanding into the solemn meditation. "You don't want a divorce?"

"Great Scot, I hope we won't have to go as far as that."

"No, no, sir, of course not." Mortlake said quickly. "Now then,

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let me get this straight, sir. Am I to gather that your problem centers upon a vuphone and its irremovable fixation in your domicile due to an exorbitant attachment by your chosen female of the species?"

"Uh," Birk thought it out, "yes. I didn't want it put in in the first place, but Lena . . . that's my wife . . . she insisted that we give it a trial. Now it's like opening night at the Crudpuddle Rep all the time."

"'Vanity, vanity, all is vanity, saith the preacher,'" Mortlake misquoted. He mused. "Oddly enough, I had a vuphone divorce only recently. By appropriately leaving the receiver 'off the hook', as it were, it can act as an excellent instrument for surveillance. Suitably aimed, of course. Do you have a recorder on yours, to take down messages, or to make note of usage?"

"No, I haven't."

"Oh well, I should, sir, if I were you. For a small extra cost, it pays for itself time and again in the peace of mind it can bring. And, of course, it can provide very convincing evidence in a divorce court."

"But I don't *want* a divorce!" Birk shouted.

"Ah, yes, sir, I was forgetting. Still, you never know your luck, you might one day. Yes, now," he turned his hawk-eyed professional attention up to full, "you are, it would appear, having some difficulty convincing your dear spouse of the pernicious factors attendant to the possession of such an electronic marvel within the household. Tell me, sir, please, of your problem, and how it might be that I may be of assistance."

"Well it must be legal, and it must be discreet." And Birk told the detective of his objections and of the obstacles.

Birk did not like it, but the advice was not free and, despite his distaste, he thought that the maneuver just might work very well. But he had to confess later to G.S. Mortlake, detective, that his application had been a failure.

"You couldn't have been raw enough," Mortlake opined. "You couldn't have been sufficiently revolting and disgusting."

"She made me feel like an idiot. Even wearing a mask and speaking through that thing I got the idea that she could recognize me."

"But how did she react to your filthy remarks? Wasn't she shocked at all?"

"She didn't seem to be. She seemed to enjoy it, if anything. She even asked me if I'd call again."

Mortlake wagged his head. "You couldn't have done it properly. You were too gentle, probably. You should have been vile, dirty, let yourself go, made prurient remarks and obscene gestures and suggestions."

"I'm not really cut out for that sort of thing," Birk answered somewhat stiffly. "I did my best. Apparently it wasn't good enough."

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"What you need, sir, is an expert, if I may say so," Mortlake ventured judiciously, "someone with the hair-curling turn of phrase, and with no inhibitions whatsoever."

"Yes? And do you know of such a person?"

"With your permission, yes, sir, I do. He is a merchant seaman, a Mr. Tiger O'Toole, sir, a person of highly diverse accomplishment. But in an unusual case such as this, I'm not at all sure what fee he might expect."

"As long as it is not *too* outrageous," Birk said, "and he *is* good—"

"Never," and Birk was genuinely and thoroughly astounded, "have I ever seen such a filthy, such a lewd and perverted exhibition in my life." He broke from the profane spell cast by their leering, jibing, odiously gyrating caller, and leaped to break the connection.

"What?" Lena was startled. "What did you do that for?"

"What for?" Birk was amazed. "You can't be serious? That . . . That coarse, ugly, *despicable* swine!" He shivered. "A stranger. Just like that in our own home. It's . . . I'm going to call the police."

"Oh, really, you do carry on," Lena groused. "What harm was he doing? He didn't bother *me*. He was quite amusing in an unbalanced kind of way. At least he had more originality than the one who called a couple days ago."

Birk halted in his reach for the dial. "Uh. Er, people like that have called you before?"

"Darling, you do seem stuffy at times. Why get excited about such cranks? I suppose that they will get caught in time, but mostly they're just acting out their frustrations."

"I see." Birk was wide-eyed. "They can voice their crude innuendos in our parlor, can they? Can call you names and make disgusting invitations right here in our own home? Oh yes, I can see myself allowing that."

"Birk, really," she shook her head, "it's just an isolated incident, and it *does* add the spice of variety. He was even better than some of the movies."

"The movies?" Birk queried. "What movies?"

"Oh," Lena paused, shrugged, "one or two of the girls have these interesting tapes and, well, we cheat a little, make a sort of party-line, and all look in while they get played over."

"A voop-club affair," he noted coldly.

"Darling, it's only one small item on the agenda. Tomorrow, for instance, we're all going to help Janet pick out her trousseau, and also discuss flower arrangement."

Birk was staggered by the nonchalance, the casual impartiality displayed towards such contrasting subject matter. Just for the moment he could find no words.

"I'm stuck with that voop-talker,

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Mr. Mortlake, stuck with it. The thing is supposed to be a utility, but all it's doing, I am convinced, is shredding nerves and promoting insincerity. Everybody smiles and tries to come on like an m.c. of a quiz contest. And by no means is it an aid to speed communication. People spend more time looking at each other and beating around the bush than they ever did with the old simple sound-transmitter."

"I find this case very intriguing," Mortlake conceded. "Sounding around, I have learned that yours is not entirely a singular reaction. In fact I have become encouraged to think that discovery of a combative element could provide a fruitful condition for enterprise."

"Other men have the same problem?"

"I couldn't have phrased it better myself, sir. The system has drawbacks in business, mainly in the reciprocal stress occasioned by the need for complete role-playing by both juniors and seniors. The protection of invisibility has been stripped away. But mainly it is in the home, sir, as in your case, with the wife. It would appear that the vuphone strikes a responsive chord, an irresistible challenge, we might say, sir, to the female mentality."

"You think so?" Birk fidgeted. "Why do we put up with it? Why are all the business houses so eager to have them put in to make everybody jumpy? Even the bosses don't really like it."

"It's the latest thing, sir, and modern people cannot afford to lag in adopting an 'improvement', can they? If one firm has them and is suffering the innovation, a less progressive firm stands to earn the unenviable label of being a piker."

"There seems to be no resistance at all," Birk grouched. "They can't seem to get the new viewers installed fast enough."

"Once the trend is set by the prestige-conscious ultra-moderns, sir, the rest feel obliged to follow suit, whether they like it or not. And, of course, the vuphone people didn't spend millions to invent their toy for nothing, and their promotion is not stinted. No, sir, it would be unwise to underestimate the latent power of this instrument. It is fast becoming the accepted and established form of contact over distance. Very soon the plain sound device will be an anachronism."

"Surely there's something we can do? After having to make faces all day in all sorts of unavoidable confrontations, a man doesn't want to have to go through the same thing when he gets home. It's a bit too much of a good thing."

"I have been giving my mind to the subject, sir," and from Mortlake this was a grave submission that such applied rumination was not at all to be despised, "and I can anticipate how formidable the task of retaliation may be. However, the rate of change is being conducted almost

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with unseemly haste by its operators, as though they might sense, perhaps, that if they do not reach the point of no return quickly, then they might start meeting subscriber opposition."

"Point of no return?"

"Yes, sir. At present there is overlap and interchange with sound-only calls, and everybody understands this. But unless a solid case can be made for the retention of the sound-only phone, it will be forced to go the way of saddles and harness—a possession for poverty, or refined for special occasions."

"I'm doomed then." Despondency sat upon Birk. "Unless I become a hermit. I have to tolerate it or become an outcast. If the threat of being subjected to the most flagrant obscenities fails to distress and cause fear of repetition, what else is there?"

"It's the moving picture, sir," Mortlake pronounced, "and TV and films have inured us to such things. Also the witnessing is private, not public, which can eliminate much source for personal embarrassment. It's only a machine, sir, and we control it, don't we? We can always switch it off, can't we?"

Birk sighed. "Then you can offer no solution, Mr. Mortlake?"

"Ah, now, I didn't say *that*, sir." Mortlake was modestly buoyant. "You have my sympathy, sir, and as I remarked earlier, there is distinct prospect for gaining further clients if a successful combative technique could be contrived."

"If it was legal, yes," Birk said, "It could become a very profitable sideline for you. Are you regarding me as a guinea pig?"

"If you'll pardon me, in a way, yes, sir. You see, as I see it, sir, what is required is the awakening of the sense of inadequacy and discomfort. An unhappy experience, repeated perhaps, when using the vuphone—?"

"Something different from filth? Are you thinking maybe an electric shock every time she switches on?"

"Er, no, not quite—but you're on the right track. Don't you think, sir, that medical therapy used to help smokers stop smoking and drinkers stop drinking, might be employed to discourage vuphoners from vuphoning?"

The circles went around and around working towards the middle, in easy rhythm, endlessly, being constantly replenished from the sides.

Mrs. Ocksen watched, her head slowly tilting, her eyes widening to glaze as she tried to follow the whorling. And the voice droned, "Watch closely, closely now, to see if you can spot the clue that can win you a brand-new luxurious Sleepytime bedroom suite. Sleepytime, beautiful sleep mattresses, soft, soft, sleepy pillows, wonderful Sleepytime, sleepy, sleepy, so sleepy, you want to sleep, you just love to sleep, sleepy now, so-o-o sleepy—"

And Lena quite soon succumbed to the gentle hypnotic suggestion.

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"Honey, gee, you look terrible," Birk said sincerely. "Are you ill?"

"Yes. No. I feel awful. Oh, Birk." She put a wrist to her hair. "I've had a stinking day, stinking. You . . . You don't know, you just don't know."

"Yes? What happened, sweetheart?"

"Everything." He could see that she was near to tears. "You don't know. Everything went wrong, everything. I . . . I . . . I tried—"

"There, there, sit down. Would you like to tell me all about it?"

"Birk. I . . . I don't understand it. I just seem to be cockeyed all day. Alicia Baitland called, and I had my hands full of cake-mix. It's like glue. But I have to stir it, I *have* to, otherwise—Alicia must have thought I was mad. I couldn't get rid of it. It seemed to stick everywhere."

"So I see." Birk eyed blobs and smears of evidence.

"That's how it started. I wanted to make a cake. All day," her lip quivered, "all day I've been trying to make a cake. But every time I got it ready, the . . . the phone would ring. Birk," her fingers agitatedly kneaded the mixture in the bowl on her lap, "why can't people let me finish making it?"

"Uh. well, they didn't know, I guess."

Lena scraped her fingers on the bowl-rim, knuckled her eye and sniffed. "They thought I was peculiar, I could tell. And then there were three of them. Birk!" she cried, "you don't know! They pointed at me and laughed!" Her face crumpled. She wailed. "I couldn't help it. I was only trying to make a c-cake, B-Birk—"

Birk felt keen piercings of guilt. He ignored the effect that scattered sticky substances might have upon his suit, and he sat to place a comforting arm about her. Her beige cocktail dress was as daubed as a painter's smock, and beads and droplets hung in her battered upswept coiffure, offsetting her earrings and three-rope pearl necklace.

Birk quelled recoil from the heavily-coated hands and forearms. "Easy, honey, easy."

"But it shouldn't be so hard to make one l-lousy cake. Look—Look at the state I'm in! But I *had* to, and . . . and everybody—" She surrendered to misery and threw her arms around his neck. "Oh, Birk!"

"I'll get it."

"No. No, I have to, I—" Lena struggled up, clutching her bowl. She faltered. "Always in the middle—"

Birk gripped her shoulders. "O.K., you go in the kitchen and finish making the cake while I see who it is."

"But I . . . if . . . if it's someone for me, I should—"

"I'll let you know. Forget it, now." He turned to step to the compelling ringing. A prisoner to her unwanted planted drive, she trailed in his wake.

At the vuphone Birk paused.

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Much goo had transferred itself to his person. The mirror showed him blotched up to his ears. With no time for repair, for expediency he plucked a larger lump of cake-mix from his lapel, divided it, and stuck the two balls to block the pick-up lenses.

He switched on. "Hullo?"

"Huh, what? Ocksen? Ocksen, are you there? Are—"

"Who's that?" Birk asked, grinning at the face of Mr. Flodrankle straining to make out some impression on *his* screen. "Is that you, Mr. Flodrankle?"

"Yes, it is." Flodrankle's finger flicked. "What's wrong with your set, Ocksen? I'm not getting your picture."

"No, sir. It seems to have blanked out." Birk put his thumbs to his temples and waggled his fingers. "I guess there must be a fault in the circuit somewhere. All I'm getting here is a foggy night, sir. Sir—you *are* there?" And he stuck out his tongue as far as it would go.

"I'm here, Ocksen." Flodrankle sounded peeved. "I wanted to show you this . . ." he held up a diagram. "I wanted your opinion. But if you can't see— Get it fixed, Ocksen, as soon as you can."

"I'll try, sir."

Birk was frozen in his lip-flipping when his boss made a very rude motion in his direction before hanging up.

"I suppose you've done quite well, judging by the fall-off and retraction in vuphone use. Some of it will no doubt be due to your efforts, eh?"

"Very little, sir, I'm sorry to say," the head of the G.S. Mortlake Inquiry Service confessed. "There *was* a spasm of hypnotic competition, but the reversal comes, I fancy, from much more natural and mundane causes. Do take a seat, Mr. er . . . Ockser, isn't it?"

"Ocksen," Birk corrected, seating himself. "I have been curious whether you have had many other cases. Humiliation is rather a drastic weapon, but it can prove effective." He was just a touch wistful. "It seems nice when the opponent swings around to being the one pressing for removal."

"Yes, sir, reprehensible but satisfying. Could it have been retained for special employment in certain individual cases, the method could have been a useful means for continuing profit for years to come. Unfortunately the rot has set in and is already depriving us of the abundant situation."

"I see. That seems strange. I thought the trend was here to stay, keeping up with the Joneses."

"Abuse, sir, vandalism. Not enough allowance was made for tampering, and for the psychological effects of gross one-sidedness, sir."

"I'm not sure I get what you're driving at, Mr. Mortlake. I know there seems to be creeping disenchantment with the vuphone, they seem to be definitely going out of favor, but I really don't see why."

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"It's the blackout, sir. People who plug the transmitting eyes with gum, or sticky-tape, or paint, they're the cause, sir. People soon learn that it's not a breakdown, and that their picture is going to the other end while giving them nothing in return. To be seen while not to see is not a pleasant sensation, sir. One gets a feeling of being unfairly exposed. It's all right if the light says the call is coming from an old sound-only phone, but in any other instance, an unreceived image can only breed the suspicion that one is purposely being placed at a disadvantage. Not nice."

"No, you're right. I've had that happen to me at the office. The feeling of being watched, but unable to do anything about it."

"Exactly, sir. It is a circumstance difficult for sensitive persons to endure. And it is a tactic apt to become more common than not, public services being so vulnerable."

"Yes, indeed." Birk was reflective. "Who would have thought it, eh? Tearing away one day, and so soon going into decline in the next. Nothing seems to last long these days."

"Except perhaps the sound-only phone, sir," Mortlake observed.

"Do you think the vuphone is finished, Mr. Mortlake?"

"Oh, never completely, sir. I should say. It should retain its place in institutions and for special groups, I don't doubt. It's just that its general universality is not proving such a good proposition.

"But, sir," Mortlake bent deferentially in his chair, "you did not come here to discuss my problems, did you sir? Of course not. There is perhaps some little trouble of your own where I might be of help? A vuphone matter, is it? Your wife has had a relapse, and wants a hookup to closed-circuit, eh, sir? She's been invited to be a member of the Highborough Ladies Unlisted, perhaps? Or some such voop-club? We are hopeful to get an anxious husband out of things like that. What group does she want to join? You realize that this will call for tapping?"

"What are you talking about?"

"Sir?" Mortlake was momentarily ruffled. "My apologies, sir. From your conversation, I thought I caught intimations that you were undergoing onslaught from revived vuphone enthusiasm. My mistake, sir. Apparently."

"I begin to think that you have a one-track mind, Mr. Mortlake. No, my domestic relations have become strained of late, maybe because . . . Look, you're an inquiry agent, aren't you? Well, then, I want you to inquire. I want a divorce, Mr. Mortlake. I'm pretty sure that my wife is running around with some other fellow, and I've more than a hunch that he's a certain Tiger O'Toole. You see, I think she might have started adding things together, and then things really went bad when she found Susanah's number. That is, I only wrote it down, that was all, but she wouldn't believe me, see, Mr. Mortlake? And so—" ■

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continued from page 43
they wouldn't dare. The anti-G straps for the calves could have fixed that, but she didn't bother.

She also removed Joel's helmet.

By the time she had reached the South Pacific, they had recovered.

"Shut up!" she barked. Ynga was taut with desperate rage. At the very least she'd have revenge—

Joel was frothing. The other was very alert.

"I'm making the threats," she told them. "Where are my husband and son?"

Neither responded to the question.

Ynga grinned tightly and cracked the spill valves. Air fluted melodiously out through the whistles. A sound that would be recognized by anyone who watched adventure records.

They began to sweat, but the little man seemed determined to call her bluff. She grinned like a wolf. Both were singularly ignorant of aerospace flight. The air got thinner and thinner. Joel's monotonous threats grew thick.

They weren't yet gasping for breath when Ynga shut the valves.

"Tol' you," breathed the smaller man. "Jus' a bluff. Tough femm, b'not tough nuff."

"That's what I thought," said Ynga. "You'd never dare try to invade a private apartment. It was all a bluff."

She had to let out more air before they started to spill. The little man knew everything. Before he passed out he was babbling drunkenly that Bill would never see daylight again if anything went wrong. Nobody would ever find him on that seafarm. Shrewd questioning also gave her the proper code words to radio her arrival with. Some close checking of Joel's flight orders gave her the location.

She gave them more air and turned on course, ignoring the radio.

Ynga was quivering with exhaustion and tension and soaked with sweat, but she held herself in taut control. She couldn't depend on the authorities to get Bill and Pete out alive. On the other hand, the gang would be expecting her to come flying tamely in any time. She teetered indecisively between alternatives.

Finally she decided to go in. At least they'd be together.

When her captives awakened again they were grimly silent. Joel glared at her with real hatred now. She ignored that contemptuously. Approaching the seafarm at high altitude, she warned them: "You haven't seen the all nor the worst I can do while I've got you inside this bird. Try anything and you won't live to regret it—even if *Rival* is sitting flat on the water. Believe me."

They did.

That bluff should hold them until they were down—and they couldn't fly the bird anyway. She looked the farm over as she spiraled in, giving the code words. No comment at her voice; she'd expected to have to force Joel to give the words.

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Chewing her lip, Ynga spiraled in, still high, still supersonic. She had the guns but she'd have to leave *Rival* and go hobbling in to use them—alone and under their observation. Couldn't be done. But if she pulled out and ran now, it'd be wet curtains for Bill and Pete—

She bumped up the magnification on the forward visiplates. They had a telescopic circuit to simplify docking in space. Searching the ground, desperately looking for a way out, she coaxed the big high-speed bird in.

"Come right in beside the dome—that wing can land on water, can't it?" asked ground impatiently.

"Check," she said automatically, putting *Rival* into a steep dive preparatory to leveling out on hover and skimming in to the clear water beside the watch domes.

Then she caught her breath.

A seafarm is essentially a series of tanks full of plankton. The mile-square tanks were merely thin plastic sheets supported at the upper edges by floats. The water in them was brought up by solar-powered pumps from as much as half a mile down. At that depth, beyond the reach of the sunlight, there are no plants to fix organic compounds, and the water is so rich with them they precipitate out. This rich water, brought up to sunlight and fed to plants, not only supplied a third of the world with food, but also supplied a third of the world's organic raw materials.

The process lended itself well to automation. The pumps were automatic, the plants grew naturally, fish rarely got into them—and in most cases would promptly have died if they had—and even harvesting was automatic. Pumps picked up the water, centrifuged out the plankton, and sent it along for pressing and drying. Men need only come by at intervals to collect it.

This farm did no processing. Thus, no permanent buildings were needed, only a few domes for the watchmen, who also made on-the-spot repairs. Permanent buildings would have been floating, submerged jobs. But since worldwide weather-conditioning eliminated hurricanes, nothing was needed for the watchmen but inflated domes floating on pontoons.

"Forgive me, Bill—Pete," she whispered as the big bird came in, and squeezed the throttles.

For a half-second she feared the big rams would falter. The howling gale of dense wet air pouring through them at this altitude was already causing them to run hot. The electromagnetic fields weren't able to keep the plasma away from the throats. Now she dived into thicker air, still at supersonic speeds.

But all jets are overdesigned. They held, running hotter and hotter—but they held. *Rival* was making better than 1900 miles per hour as she pulled out over the domes. In the climb, the jets finally faltered. The pyrometers tripped, the safety switches were thrown, and the plane

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quivered as its driving force vanished. *Rival* seemed half-dead, as sluggish as she felt, as Ynga whipped it into a turn on the turbojets, nose down again.

It was a slow turn. Out of it and making for the domes again, her teeth clamped on her lip at the havoc the single pass had raised.

The domes were down. Unidentifiable bits and pieces were scattered here and there. The body of a man was floating face down in the clear water beside the floats of the domes, apparently having been knocked off the company boat at the dock. It couldn't be Bill; Bill would never wear tartan plaid pants in "incandescent" red and green.

Ynga put *Rival* down hard and fast, her head snapping, the arms of the men, caught behind them, straining. Ramming the nose against the dock, she scrabbled up the guns, unhooked herself, started out.

Remembering the men, she hesitated, torn. After a moment, hefting a pistol, she stepped reluctantly back. Her face reflected her strain. The shock, on top of all the day's mental and physical shocks, was too much for the half-tough Joel. To Ynga's grim and everlasting delight, the mustard-moustached muscleman fainted.

She contented herself with tapping the head of his boss. He lapsed into unconsciousness readily. Then she was out and running across the dock.

The South Pacific sun hit her through the helmet, the glare arrowing into her eyes. Water lapped, flashed; white floats glared; even the sunpower screens reflected light apologetically into her face. The heat of the tropics smote through her sweatsoaked pressure suit. The salt sweat irritated the raw spots under it. After a few moments she slowed to a rapid, stumbling walk.

It took seconds of clawing at the collapsed fabric to find the door to the first dome. The plastic was set for translucence; it was light inside. She lifted it with her helmet. Three men lay sprawled unconscious, bleeding at the ears and noses, around an overturned card table. One breathed stertorously. Beyond, in another room, were two other men in bed. The plastic was dark here—the night shift. Fumbling past, she found the galley. Opposite it was an empty room with a chair and a big visiplate. The 'plate was overturned but still playing a Western record.

In the floor was an opened trapdoor.

Ynga caught her breath, almost plunged through it headfirst, trying to look. "Bill!" she called.

"Ynga! For God's sake! Do they have you? What happened?"

She could make out the sprawled body of a man—a body beyond doubt; his head was doubled under him. Fallen through the hatch, doubtless.

It was twenty feet down. After several moments of mental confusion, she placed it as a sub dock. A small sub was used to check the bottoms of

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the tanks for leaks or fish damage. The dock was for emergencies and doubled as a decompression chamber. Small subs are unwieldy on the surface.

"Bill! You all right? Wh-where's Pete? Bill!"

"O.K., here I am." She saw him looking up. No need to tie him up down there, there was no way out but this. "What do you mean, Pete? He's in school. Home, now," he added, looking at his chron.

"Th-they said they had you b-both. Oh, Bill! C-come on up."

"Let down the ladder. What happened up there? It sounded like a cannon down through this manhole."

Ladder, ladder. She peered under the plastic. "I-I don't see—"

"Built-in, automatic. Look at the edge of the hatch."

Ynga looked, saw a button with an L, hit it. The ladder spewed out of a mouth just under the hatch. A link ladder, with wide flat rungs but uprights of jointed links the size of matchsticks. It retracted to allow room to lower equipment down the shaft.

Bill came up quickly, stared, his height lifting the collapsed dome off her head.

Ynga explained quickly, leading him out, leaning on him for support. Twenty feet under water, he'd merely been almost deafened by the shock. Some of the gang were stirring as they clawed their way back out from under the light plastic. She gave Bill one of the guns.

He took it casually, almost absently. Behind his heavy, horn-rimmed glasses he wore an air of almost childish wonder with a dash of disdain for his erstwhile captors. He did not seem troubled even when they saw the small man glaring at them from *Rival's* cabin door.

"It lacks a lot of being a competent gang," he said, ignoring her gasp. "Fanatics would be likely to hire third-raters to do their dirty work." The small man's head disappeared before she thought to raise her gun. Bill still seemed unmoved.

Rival had floated some thirty feet away from the dock.

After a moment they heard the whine of the turbines. "He must've been watching everything I did, studying the board," moaned Ynga. Bill pushed his glasses back on his rather blunt nose, shrugged clumsy hulking shoulders in the mannerism that made him seem so ineffectual and—studious.

The rudders on the giant dorsal fins swung hard over. The jets on one side sounded louder than the others. "Going to try to fry us with the jets—the damn fool," muttered Bill.

After a moment Ynga saw what he meant. A hundred-ton aerospace transport can't be handled like an airboat, much less like a rowboat. It obediently swung to the right, but came surging forward much faster. Bill backed away, hesitated. *Rival's* swinging prow did not quite touch

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the floating dock--a great hawk moth brooding on its sins, ignoring the water creaming under its beak. She saw that it would make the turn and started to drag Bill away from the jet exhaust.

But he was off and running before she could speak. She saw his glasses bounce absurdly on his flat nose. He took off in an impossibly long leap--through the still-open door of the bird just as it began to recede from the dock.

Ynga's scream mingled with the sound of the jets.

He hit the deck in a sprawl, rolled completely over, losing his glasses. Then he was gone in the dimly-lit interior.

Ynga hobbled frantically along the dock after the receding nose of the plane. She dipped one toe in the water, hesitated, not remembering--if she knew--whether her pressure suit would buoy her up, or drag her down. The gap was much too great to leap now, even unhampered.

"Bill!" she screamed.

Then the jets died.

"Bill!"

"O.K., what do I do now?" he asked her, appearing in the doorway.

In the sudden silence, her sob was as loud as a shout.

"The little guy?" she asked fearfully.

"Dead," he said, shrugging. "Brace up! It's been a rough day, and you've had the worst of it, but it'll soon be over. Just tell me how to get this bird back to the dock."

It took her a moment to catch her breath. "S-set everything on dead center," she said.

He frowned uncertainly.

"The go-stick." She could see the rudders. Below the plane, retracted on ground--she hadn't bothered--were their smaller counterparts. They had to be turned to dead center. The rudders hadn't enough bite in air to steer at low speeds like this, but those down in the water did.

With some fumbling, he managed to square them. "Now what?" he asked. She told him where to find the compressor turbine controls and how to turn them to start position. Hesitantly, he fired up some of the turbojets. The multiple scream pushed the plane forward slowly, slowly. It bumped the dock as she was hobbling down toward it.

Bill gave her a hand in.

He looked out at the deflated domes. Ynga followed his glance. Most of the living men seemed to be conscious. Motion was visible under the plastic. Three men sprawled across the domes' floats, holding their heads. No doubt they were all deaf--some permanently.

"No point in trying to hold them," said Bill. "They can be traced easily enough from the dead. And they're wounded. Besides, they don't know who hired them. We'll call the authorities and let them handle it. Better call someone right away or you'll lose your license."

The little man was quite dead, with a broken neck. Joel was wide-

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eyed and sweating, conscious but still strapped in. They ignored him. Ynga took the pilot's seat, felt relief flow upward through her from it. Here she was in her own element.

The radio was blinking angrily.

She turned to the flight-control wavelengths and cut into a babel of voices, most of them angry. Some appeared to be patrolmen. Her explanation wasn't easy to make. She tried to be concise, but the incredulous interruptions slowed her. Some parts of it she held back; these wavelengths weren't secure, and flight control might talk to the press.

It was ten minutes before she got flight instructions, and they were promptly countermanded by a sharp voice which told them to sit tight. Minutes later a fast little courier screamed in—blue and green. UN Treaty Forces. They patrolled international water, air and space under the terms of the various treaties among the Blocs.

Their commander was a Japanese lieutenant with an almost British air. Joel and his boss were removed, with their guns, and their stories recorded. Ynga told them everything she had done.

"It leaves just one question," mused the patrolman, packing away his equipment. "Who's behind it all? One of the big corporations?"

"No," said Bill calmly. "The Lunar Separatists. They're the only group around that would be crazy enough to use nuclear bombs. I had plenty of time to think," he ex-

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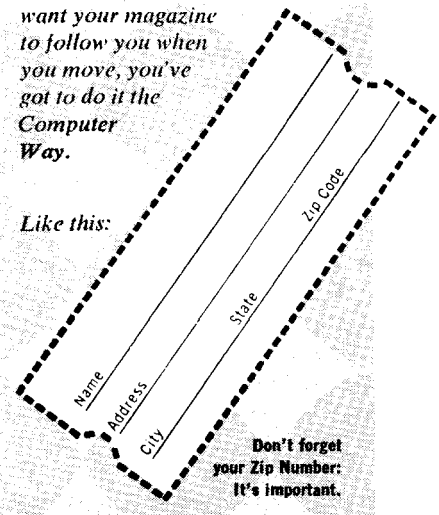

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plained to Ynga. He gave the same reasons she had used in concluding that the cargo they had put in pickup orbit had to be either fissionables, or breeder isotopes.

"Wait a minute," said the patrolman, eyes narrowing. "That's not under our jurisdiction, but we know pretty much where every gram of that kind of stuff is. None of the Armed Powers would let much of that stuff get away. And you need ten kilograms just for one crude bomb."

"Not anymore," Bill assured him. "I'm a research nucleonic engineer. It's not generally known, but the alphabetagen excitation problem's been cracked. You have to mix small percentages of fissionables into the fuel sticks, though. And the result isn't a nice, gentle, controlled rate of breakdown. Instead, virtually every unstable atom in the stick lets go at once."

"Whew!" whistled the lieutenant. "An alphabetagen bomb! So they had a few kilos of breeder isotopes, thorium or U-238, in one of the canisters. That'd give 'em enough fissionables for several hundred smallish bombs for sabotage." He grinned at Ynga. "They'll hate you, pilot!"

They were not held long after that. They were ordered back to Galveston, where further questioning would await them. Ynga was relieved by a report from flight control; a call to their apartment revealed that Pete was too engrossed in homework to come to the phone.

Bill seemed to hold his breath while *Rival* climbed skyward. When the big rams were off and the plane in suborbital above the atmosphere, she demanded, "Now you tell me how you managed to break that professional muscleman's neck—professor!"

"The company's physical fitness program—remember?" he asked. "Calisthenics, court sports, boxing, wrestling—and karate, savate, and whatever else we require to keep us interested."

"And you never told me! I worried myself almost sick. Just like a man!"

Bill laughed, looking up at the star-spangled blackness above. "They will hate you, too, Ynga," he said, at a tangent. "Having to sit and watch their swag float by just out of reach—they'll have plenty of time to brood on the wiles of women. They won't dare use their fusion rockets—not after everybody's been alerted."

She shrugged, as he had before, at the obvious. "Boiling off ammonia to reduce the plane's mass, was obvious," she said. "Of course that puts the canisters in a faster orbit—one farther out. I'm only a truck driver, and a Terrapin at that, but that much astrogation anybody knows. It might even be a solar escape orbit."

He laughed again. "So smugly and calmly floating past, ignoring them—just out of reach. Just like a woman!"

"Serves 'em darn well right," she muttered vindictively, looking up at the sky. "Try to skyjack my truck, will they?" ■

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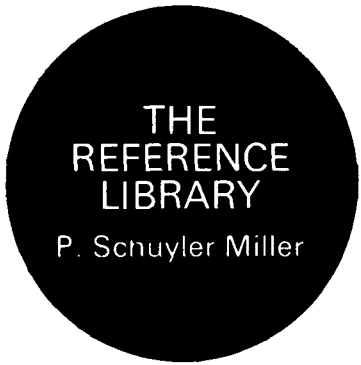

Another Country Heard From

Josef Nesvadba is a Czechoslovakian physician and professor of psychiatry at the University of Prague who was introduced to us in Darko Suvin's anthology of socialist SF, "Other Worlds, Other Seas," and who is included in the latest Harrison-Aldiss anthology, "Best SF: 1970." A collection of his short fiction seems to have been published in England in 1970 under the title "In the Footsteps of the Abominable Snowman"—the last story in the collection. Renamed "The Lost Face" for the story Harrison and Aldiss liked best, the collection has now been reprinted in the United States by Taplinger Publishing Company—215 pp.; $5.95.

Harrison and Aldiss comment that most of Nesvadba's stories are "timeless allegories about the nature of man" set in the past of Czechoslovakia. They couldn't have described them better. On the other hand, the Czechs have a tradition of satire that you'll find under the surface of the almost Victorian plots. (I wonder what the Czech equivalent of "Victorian" is?) I remember with nostalgic delight a Czech film of several years ago, based on a Jules Verne book—"To the Flag"—that most Americans never heard of and no library has, in which the entire film was done in the manner of a Nineteenth Century woodcut—but a woodcut with aircraft, submarines, a super-explosive, and a mad scientist's hideout inside a volcanic island—rather like Captain Nemo in "Mysterious Island". Nesvadba might even have scripted it.

The title story of the U.S. edition could come right out of Hawthorne. A plastic surgeon has a secret process for "lifting" the faces from corpses and transplanting them to living bodies. He is tricked into transferring the face of a slum priest to a professional criminal, and has to put on the killer's face himself. As in the various ramifications of the Frankenstein fable, the saintly face makes the criminal a saint . . . the criminal's face makes the surgeon a criminal. Or do they?

"In the Footsteps of the Abominable Snowman," title story of the English edition, also shows the author's tongue very gently probing his cheek, as he embroiders a dust cover for the "noble savage" stereotype—Professor Suvin tells us that his books include one called "Tarzan's Death". The story is told by a stuffy Bohemian schoolteacher who agrees

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to guide the Englishman, Lord Esdale, in the exploration of deep caves where several people have disappeared. Esdale has lost his wife to a tribe of *yeti* living in a system of caves in the Himalayas, and he feels sure that other communes of Abominable Snowmen have their idyllic communes in caves all over the world.

Burroughs Bibliophiles, incidentally, may take exception to the first story in the collection, "The Death of an Apeman." It is Nesvadba's version of what would happen if an English boy were brought up by chimpanzees. The plot does not proceed along the lines of the Tarzan adventures.

These really are strange tales, right out of the main current of Anglo-American SF. Dr. David Keller, the Pennsylvania psychiatrist, wrote stories somewhat like them back in the 1930s and was considered "dated" even then. Is it a coincidence that Nesvadba, another psychiatrist, approaches similar themes in a similar manner?

He doesn't entirely avoid "modern" themes, though. "Expedition in the Opposite Direction" is a story of fumbled time travel, of attempts to change the past and future, with one of the most Rube Goldbergish time machines you can imagine—I suspect, deliberately so. "The Trial Nobody Ever Heard Of" tells us how a faculty feud in the Histology Department of an obscure Moravian university buried the discovery of a critical drug and changed the history of the world. "The Chemical Formula of Destiny" projects something like molecular biology back a generation or two, as an experimenter tries to create a *prima donna* by altering her mother's chromosomes.

Surely totally automatic control of machines should bring the millennium to a socialist country such as Czechoslovakia. However, in "Inventor of His Own Undoing" it doesn't work out quite that way. And the experimenting surgeon—no relation to Wells'—in "Doctor Moreau's Other Island" has about as much trouble constructing more efficient human beings on his island, as the first of that name had in carving animals into men.

The tone—the style—of these stories is like Jules Verne's. Dr. Nesvadba has done much what Disney did in his film of "Twenty Thousand Leagues Under the Sea," by giving his stories a pseudo-Nineteenth-Century tone—but without ever failing to make clear that he and his readers are living and thinking in our time. For present American readers, especially Analog readers, it seems to me he will be very much an acquired taste. Yet "Vampire Ltd." in the Suvin anthology isn't in this mood at all. Let's give Dr. Nesvadba another chance some time.

Addendum: The Hugos

Members of the Noreascon, the World Science Fiction Convention held in Boston over the Labor Day weekend, agreed one, two, three with

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the vote of the Science Fiction Writers of America last spring. (I reported that here in the August issue.) As usual, the news came in Charlie and Dena Brown's fanzine, *Locus*, which earned them a Hugo apiece as best in its field.

Since the categories for the Hugo and Nebula (SFWA) awards are different below the novel level, the same stories took awards in different classes. Larry Niven's old-fashioned galaxy spanning "Ringworld" was best novel. Fritz Leiber's fantasy in his Grey Mouser series, "Ill Met in Lankhmar," was best novella to both groups. But Theodore Sturgeon's "Slow Sculpture" won the Nebula as a novelette and the Hugo as a short story. (The Science Fiction Writers said no short story was a standout in 1970, and the Hugo committee has dropped the "novelette" category.)

Runners-up were quite different, though. In the voting for Hugos there was a swing back to the kind of science based "SF" you look for here in Analog. "Ringworld" is a kind of cross between Hal Clement and E.E. Smith, and second in line was Poul Anderson's "Tau Zero," a "quantitative SF" book about a tour of the universe at near-light speed. Robert Silverberg's "Tower of Glass," one of the "new Silverberg" novels that are making the "New Wave" both unnecessary and yawn-provoking, came third. In any other company, either of the runners-up could have won hands-down.

I've read only one of the two also-rans in the novella class: Clifford Simak's "The Thing in the Stone," about a man who can tune in on the gossip of the universe. Harlan Ellison came third with "The Region Between," which I will now look for and—I am sure—enjoy.

My own choice as best short story, Gordon Dickson's "Jean Dupre," came third. If it weren't for the way the voting for the novels went, I'd have been tempted to second-guess this as the reaction of the younger fans, in opposition to Establishment values. I wish it had come in another year. Second in the voting was R.A. Lafferty's indescribable "Continued on Next Rock," in which a pair of seeming immortals carry on a courtship over the ages in a way that only Lafferty could describe.

Analog placed second among the magazines. *Fantasy and Science Fiction's* combination of fantasy and science fiction gives it an edge—in fact, gave it *the* edge and the award. The truly amazing resurrection of *Amazing* under Ted White's editorship got it a third place. (This year, incidentally, the runners-up got more than just a mention here: the committee gave them scrolls.)

Analog's Kelly Freas—who has a shelf of Hugos anyway—also dropped back to Number Two in the "best artist" race. First went to the husband-and-wife team that have done the covers for the Ace Specials, Leo and Diane Dillon, and third to Jack Gaughan.

We don't try to cover fandom

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here, except when it becomes especially useful in bibliographical or other ways. *Locus* earned a first for the Browns, and *SF Review* a second for Richard Geis—who has just terminated it, and who was voted best fan writer. Third went to a 'zine I haven't seen, Michael and Susan Glicksohn's *Energumen.* Those who publish together win awards together. The fan artist and writer awards won't mean anything here; if you are fannishly active, you already know anyway.

First Fandom, an organization of fans who were active 'way back in the Dark Ages, had voted John Campbell its special award for service to science fiction before his death. It was awarded posthumously. There will be a research award in his name, and there is a move to talk the Postal Service into printing a commemorative stamp in his honor. You'll undoubtedly hear about these through the editorial columns of the magazine.

It was a big convention—2,100 members, over 1,600 attending—and a successful one. I wish circumstances hadn't prevented my being there. Next year it's Los Angeles—membership $8.00 in advance to LACon, Box 1, Santa Monica, CA 90406—and the vigorous Dallas crowd wore themselves out and conceded to Toronto for 1973—their second. Advance membership $5.00 to Torcon 2, Box 4, Station K, Toronto 12. Supporting membership is $2.00 less in both cases; last-minute membership will be more, of course.

CHAPAYECA

by G. C. Edmondson • Doubleday & Co., Garden City, N.Y. • 1971. • 163 pp. • $4.95

This is reported to be the author's third science-fiction novel. I apparently missed the others, and if I did, and they were as well written as this, it was a bad mistake.

The story itself is old stuff. What counts here is the way it is told. Nash Taber, an anthropologist crippled by a bad accident, decides to make one last field trip to the Yaqui Indians of northwestern Mexico—the people of the mountains and deserts who have never relinquished their independence as a nation and a thorn in the side of the government. Persona non grata because of a feud with the FBI, Taber is taken to a hidden settlement in the back country . . . where he finds the *chapayeca,* a long-nosed, blue-faced alien from a wrecked spaceship. Evidently "Chap's" people have visited Earth before, for some of the Yaqui demons are made in his image.

Taber and the alien are hounded out of the Yaqui village by an Indian activist and hunted across the countryside by him and by the Mexican authorities. They find the spaceship . . . repair it . . . escape to the States. (Chap wants to be "rich," whatever that may mean to him.)

Formula stuff? Don't you believe it! Edmondson must know his Mexican back country. His wife is a Ya-

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qui, so he has reason to know and understand them, their ways of living and thinking, their values and motivations. Nor does he treat the Mexican "villains" as anything but determined individuals doing their job as they see it. The book won't win prizes, I suppose, but you shouldn't miss it.

TALES OF THE FLYING MOUNTAINS

by Poul Anderson • Collier Books, New York. • No. 01626. • 253 pp. • $1.25

I am sorry I didn't manage to report on this last year when Macmillan published a hardback edition. By the time I heard it was out, the publisher had converted it to a paperback. Such are the problems of living in the hinterland . . .

The book isn't one of Poul Anderson's best, but it shows his ability to combine "quantitative" science fiction with action and human problems. The tales are told by members of the crew of a spaceship bound for Alpha Centauri. They are episodes in the evolution of the Asteroid Republic, from which the ship has been launched, and of man's scientific and social advance to the stars. Four of the stories appeared here in Analog in 1963-1965 as the work of "Winston P. Sanders," who is also the narrator in the interludes that stitch the book together and the hero of the last story. One, "Sunjammer," I am sure you have read before.

The gimmick that launches the series bears a remarkable resemblance to the "Dean drive" of famous or infamous memory—depending on your politics. Here the principle is called gyrogravitics—the geegee drive for short—and attributed to an inventor named Quentin Emett who gets government backing for all the wrong reasons—political ones. Or is Poul Anderson suggesting that there may be such a thing as political science?

The preliminaries out of the way, we move into the asteroid belt—the flying mountains of the title—where quantitative science fiction comes into play very convincingly. Will you think about the thesis that it will be more practical and economical to establish colonies in the asteroids than on the Moon or Mars? Will you consider the social and economic consequences of such a move? The political forces that come into play? The technical problems of harvesting Jupiter's turbulent atmosphere for incredible gases? How to protect Earth from the explosion of a mere eight hundred tons of reactive—furiously reactive—gas some ten thousand kilometers out in space? Or—sociologically the trickiest of the lot—what kind of crew you would put on a starship that will be in space for decades or generations?

It is because Poul Anderson does this kind of thing so very well that he epitomizes the best kind of "old school" science fiction . . . yet never gets awards for any one book or story.

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brass tacks

Dear Mr. Campbell:

Enjoyed both the concept and accuracy of Mr. Thomas's "The Swan Song of Dame Horse." That was in the June issue, of course.

I've spent six months working only drug cases in the Cam Ranh Bay area of Vietnam as an Army Criminal Investigator. One of the ideas we have never been able to get off the ground is to insert false, though harmless, heroin into drug supply channels. We hoped this would have the same effect as the release of sterile female pests to eliminate such insect pests. Needless to say one doesn't find such channels 'open to the public'.

Another idea has been to use a powdered nalline or other neutralizer of heroin as the fake stuff; same problem, though. A take-off from getting this stuff in drug channels is to put it in our chow! Trouble is I doubt if these drugs, such as nalline and one called Lorfan, which must be injected, will be effective if they have to pass through the stomach. If such an idea worked, it might even be added periodically to the water supply. Unfortunately, this is another of those ideas which we have no time to work on.

JAMES V. VANDIVER
Det B, 8th MP Gp (CI)
APO San Francisco

I doubt that drug handling channels are very clean. How about finding a fungus, bacteriuum, or yeast that likes to ferment heroin—and getting that into drug supply channels?

Dear Mr. Campbell:

As for your statement at the bottom of the first column on page six of the August issue, "Since no human being can truly appreciate the appalling violence of a fission explosion . . .", I am inclined to disagree with the Master. Wouldn't you say that the survivors of Hiroshima and Nagasaki have a fairly good idea of what a fission explosion is like?

Student Unrest seems to be almost—but not quite—as popular a subject as science fiction in Analog. It looks as if the Era of the Vigilante has returned.

Some months ago, *Parade* magazine—a Sunday supplement in many newspapers—gave a report about a bunch of goons who threatened stately old Oxford University in England with a "confrontation." The University's administration sent back a polite note informing the goons that several members of the faculty had served in the military services, held black belts in karate, were expert marksmen, chemical warfare experts, or engaged in similar lethal hobbies. The note went on to say

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that the faculty looked forward to the "confrontation" with readiness and "with great anticipation." Nothing else was heard from the goons.

Meanwhile, more recently but on the other side of the world, Japan treated its radicals in a more violent manner.

For many years Japan has had a criminal society of professional hecklers. These hecklers, unless paid blackmail not to, will disrupt meetings, particularly corporation meetings.

The radicals in Japan, however, have been invading these corporation meetings and disrupting them in the name of "much needed reform for the people." So, one corporation, fed up with the radicals, hired the well-trained professional hecklers to keep order at their next meeting. They also sent out invitations to the security departments of other corporations.

At the next meeting the radicals began their heckling and, at a prearranged signal, the professionals waded in and persuaded the radicals—with liberal use of brass knuckles, blackjacks, and very big wooden sticks—to stop their heckling.

Even more recently in the Bronx a policeman stopped two men who had run a red light in their car. The two men got out, beat up the policeman, took his gun and shot him. At that point a mob descended upon the two men from every direction. A tree may grow in Brooklyn but none grow in the Bronx because if one did the two men would have been guests of honor at a necktie party. The police arrived just in time to save the two men from getting beaten to death by the angry mob.

The three above incidents have one thing in common. In none of them were police required to subdue a disruptive element. The people took it into their own hands with very effective results. With the police's hands tied by rulings from various courts, I wouldn't be surprised to find incidents like the above becoming the rule rather than the exception.

I can see some besieged college dean making a deal with the local Mafia generalissimo. As you have pointed out before, the Mafia has all the advantages and none of the disadvantages of the police. They are a well-trained, well-organized force and they don't have to obey the laws as the police do. No doubt they would make a very lasting impression on some of the ringleaders of campus riots.

BUZZ DIXON
3147 Ridgecrest Drive
Madisonville, Tennessee 37354

Of course there is some tendency to make "Cool it!" a permanent state . . .

Dear Mr. Campbell:

Congratulations on Mr. Kuhfeld's excellent Spacewar article. I personally owe a great deal to the MIT Spacewar program; I was attracted to computers in 1963 because of it.

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and as a result I am now a Senior Systems Programmer working for a large electronics company. At Stanford University, where I learned Spacewar, we ran the "stagnant" MIT version on our PDP-1 until we lost it, and then re-wrote it for our time-sharing PDP-6. We obtained the CRT display for the PDP-6 by going down to the PDP-1 late one night, disconnecting it, and carrying it up to the PDP-6. Our PDP-6 version had a wrinkle which was, so far as I know, unique to our implementation: when a torpedo was fired we solved the motion equations to see if it would collide with any other previously-fired torpedo. If it would, the lifetimes of it and its first torpedo were shortened to make them explode at the moment of impact. The effect of this is that you need to do much less computation for each CRT "refresh cycle" when there are many torpedos flying. One difficulty with this scheme is that the equations of motion are much harder to solve for a toroidal space than a flat one, so we simply solved for flat space and recalculated when the torpedo "wrapped around" the universe.

There are some interesting features of MIT Spacewar which Mr. Kuhfeld did not mention. Turning is normally done by means of "gyros". That is, you turn at a constant rate while you are holding down your turn button, and you stop at the instant you let it up. By turning a switch on the console one can play the game in "inertial turning" mode, in which spin is controlled by nose and tail rockets, with the result that you must accelerate and decelerate a turn. Experience indicates that the game is much harder to play this way. At Stanford the only masters of "inertial turning" spacewar were Steve Russell and Larry Breed. Another interesting feature was provided by the lousy integration subroutine. As a result of it a seemingly stable orbit would "precess" and decay until you had to adjust with the rocket. A highly eccentric orbit would give you a random toss from near the sun at a—usually—high velocity, causing consternation to both you and your opponent. There were mixed feelings among Spacewar players when this feature all but disappeared in the move from the 18-bit fixed point PDP-1 to the 27-bit floating point PDP-6. A minor point: the stars in MIT Spacewar were taken from a previous program called "expensive planetarium" and are *real* stars in their proper positions. If you look closely, you can see them move slowly across the screen.

It may be possible for interested potential Spacewar players to buy a used PDP-1, but don't count on it; of the approximately sixty PDP-1's manufactured, about fifty-three are still in use. One of them, though, the BB&N west coast machine, PDP-1-C-7, lives right across the hall from my office, and it might be for sale. I hope not, though; I have been trying to organize a Spacewar tournament

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among my co-workers, but nobody wants to be caught by the boss while playing Spacewar!

JOHN SAUTER
Bates Road
Merrimack, New Hampshire 03054
Which shows "Spacewar" was indeed an effective educational program.

Dear Mr. Campbell:

It was with great interest that I read the article on "Spacewar" in the July issue of Analog. As a student and computer programmer I have run across a number of such games, and have some memories of similar occurrences. (At one installation I found that when a new spacewar came in from another university, the computer usage jumped 40 hr/wk until we were stopped.)

However, Mr. Kuhfeld erred slightly when he said that a CRT is necessary. When our CRT was taken away at one installation a new version was designed for our IBM 1130 which had no CRT. Instead, the accumulator lights were used as a sort of viewfinder across which a blip of light representing the enemy ship would flash—usually too fast for you to fire effectively. Further complications were introduced by having the ships stick to the walls at the Universe's edges if they had a component of velocity out of the universe, and by the fact that this boundary didn't show up in the viewfinder until you hit it. (At the most convenient machine, the game is now essentially prohibited except between midnight and 7:00 a.m.; a common fate for all good spacewars.)

The editorial was, of course, controversial. (Before I bring this issue into school I had better bring along some of the issues where you were considering ecology before I was born). It was thought-provoking, which is all that can be expected. While I am still against SST until the effects on the atmosphere are better known, I will use your editorial as a reference against those who blindly oppose anything on the grounds that it harms the ecology.

BENJAMIN M. YALOW
3242 Tibbett Avenue
Bronx, N.Y. 10463
The essence of a good computer man is the ability to get a computer to do what he wants done whether it was supposed to be able to or not!

Dear Sir:

Re: your editorial in the June issue, "Bargain Spacement." Bravo! It is unfortunate, however, that the very people that should read and benefit from your cogent essay will probably never get the opportunity. Is there any way you can spread your wealth a bit more effectively?

MITCHELL K. HOBISH
102 Colby Street
Rochester, New York 14610
The problem really is that old not-so-funny gag "Don't give me all those facts! You know I've made up my mind and you're just trying to confuse me."

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EDITORIAL
continued from page 7

matter how distinguished, a shrimpy physicist may be less likely to attract women, less likely to father more than his share of children, than a Joe Namath type.

We may have seen the beginnings of this trend. The increase of height and weight in the last several generations is well-known. It's generally attributed to better diet and less hard physical work. Though some six- and seven-foot men were found in earlier centuries, they usually belonged to the upper classes, more prosperous and leisured than their underlings. Today, in some parts of the world, this good fortune is quite broadly based.

Here too, however, we can't rightly assume that we know how things work. It's been suggested that the increase in size is due much less to greater wealth than to greater mobility. Throughout most of man's existence, he lived in tiny, inbreeding communities. But since the Seventeenth or Eighteenth Century, this has changed more and more. Given a wide range of travel, in which to meet prospective mates, couples are apt to be of correspondingly different heredity. Marriage between first and second cousins used to be the rule; today it is the exception.

So—is the growth in size of man perhaps mainly a sign of hybrid vigor? In the present state of our ignorance, only a fool will dogmatize about it.

I do feel reasonably sure that material well-being is, at the very least, somewhat relevant to this particular phenomenon. That raises another question, extremely much in the current news: Can we extend our well-being, or just a minimally decent standard of living, to all the unfortunate of Earth? Can we even hope civilization, or man himself, will survive long enough for that?

To both these questions, Marxists answer, flatly, "Yes." Liberals tend to say, "Yes, if only we can maintain sufficient good will and common sense through the present crisis." A more motley group than either of those, conservatives have varying opinions, though probably on the average they are somewhat pessimistic. And then we have philosophers like Oswald Spengler, who declared, "There can be no question of prudent renunciation or wise retreat. Optimism is cowardice."

Who's right?

Those who disbelieve that man is capable of maintaining a stable society for long at a time, can point to the historical record. Yet that record includes the fact of a few civilizations, ossified and unchanging, which have endured for millennia, like Pharaonic Egypt or classical China. It is imaginable that a world empire, well-organized and free of outside enemies, could last a million years. Termites and other social insects have done better than that.

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Can our species? We don't know.

Some thinkers deny that machine technology is viable. This is a particularly fashionable viewpoint nowadays: that Earth cannot long stand the drain on its resources, and that we must either go back to an ecologically balanced way of life, or perish.

I have news for these people. There has never been any such thing as ecological balance. At most, there have been metastable situations, which eventually broke down because of change in climate or other factors. (One of the other factors was often the formation of land bridges, which allowed advanced species to invade the territory of more primitive life forms. Man isn't alone in introducing foreign pests to a given locality!)

There absolutely has been no ecological balance, ever, when humans were around. The concept of primitive tribes living in harmony with nature is neo-Rousseauistic nonsense. Stone Age hunters appear to have exterminated most of the large Pleistocene mammals. American Indians, in the days of Columbus and afterward, were wearing out their own environment. They didn't do it as fast as the white man was destined to; but they were doing it. To cite a single example, many authorities believe the Mayans destroyed themselves by their soil-exhausting slash-and-burn agriculture. The peasants and herdsmen of North Africa, the Near East, the Indian subcontinent, took about five thousand years to effectively ruin what was once a lushly fertile belt of land. Given machinery, they would simply not have taken so long. Aristotle himself commented on the erosion which followed the deforestation of Greece. The list goes on and on.

I do not deny that the planet-wide danger is growing steadily more acute. I do deny that back-to-nature is any kind of solution.

The fact is that until extremely recent times, humanity had never heard of ecology. It is not an object, it is a science—the study of living things, their interrelations with each other and with the general environment. It is a very new science, whose ignorance still exceeds its knowledge by several orders of magnitude. At best, we are bound to make some further spectacular mistakes, before we really understand what we are doing.

For instance, if man chooses to leave nature alone to take care of itself, he'll lose his white pine forests to blister rust. The disease is only contained by unremitting effort. Or consider the ravages of pests like the gypsy moth, which insecticides were controlling until insecticides became a *bete noire.*

On the other hand, human attempts at management are often misguided. Thus, in spite of Smokey the Bear, it turns out that forest fires should not always be suppressed. Occasional large ones are necessary to the health of woodlands. By

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cleaning out old trees and underbrush, they permit new growth; and ash returns valuable minerals to the soil.

We are learning, piecemeal and painfully. But by "we" I don't mean a city-bred eco-freak who never had to cope with the nature whose doom he laments so loudly. I mean hard-headed workers with chemistry, histology, genetics, mathematics, the whole range of science and technology. Perhaps such researchers will in time, not restore, but create a true ecological balance. Nobody else has a prayer of doing it.

What we need is not less science and technology, but more, of the right kinds to replace the bad old ways. A problem—which we must take into account before we can hope to accomplish anything real—is that those old ways did not spring into existence, nor do they persist, for no reason at all.

For example, a strip mining operation which takes out the coal and leaves a desert is an obvious disaster. Yet man has to have energy sources, and copious ones. (We could return to cottage industries and muscle power—oh, yes—but the most immediate effect would be the death by famine, sickness, and war of perhaps three billion people. They aren't about to sit still for that, no matter how much easier their demise would make the lives of whales and ospreys.) Doesn't it seem that we ought to push harder for the development of clean fusion power? And doesn't it also seem that we ought to begin, now, to consider alternatives, in case fusion power doesn't work out?

Likewise, the automobile in its present form has proven itself to be an ongoing catastrophe. It may well already have done more harm than hydrogen bombs exploded in anger ever will. Yet people require transportation. Furthermore, they have demonstrated their strong preference for private as against public vehicles. It doesn't matter how good a system of streetcars, buses, or subways is available; and I have seen some in Europe that are truly excellent. Wherever given the chance, the citizenry have bought cars and proceeded to strangulate their traffic and pollute their atmosphere.

What's the answer? I don't know. I know only that there are no easy ones, such as, "Abolish the private automobile."

But let's drop this subject and consider one or two more taken-for-granted propositions. I don't suppose many readers of Analog have much patience with the claim that the space program has been taking bread from the mouths of the poor. You all know that NASA's budget, at its peak, was never more than about eight percent that of the Department of Health, Education, and Welfare. You know that this figure itself takes no account of state government activities, foreign aid, philanthropy, and other sources of help to the disadvantaged.

Have you, however, considered

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the possibility that, no matter how huge and costly it got, a space program would never seriously affect a social one? The resources called upon aren't the same. Just how many aerospace engineers, just how much liquid oxygen, could the so-called War on Poverty absorb? For that matter, does an actual shooting war really compete with the relief of do-

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3. The names and addresses of the publisher, editor, and managing editor are: Publisher, None; Editor, Temporarily Unfilled; Managing Editor, None.

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(signed) Harold G. Meyer, Vice President of Owner

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mestic misery? I don't know, but I do wonder.

And are our social programs doing any good anyway? Might they instead be making things worse?

It does look as if that War on Poverty soon turned into a war on the poor. Only of late have anthropologists and depth psychologists begun to learn what heartbreak its relocations and dislocations have caused—while Urban Renewal triumphantly presented us with half a million fewer housing units than we started out with! Once more, we have plowed grandiosely ahead on the basis of assumptions that nobody thought to question.

Is the time not overpast for us to take a long, hard, and above all imaginative look at the problem?

Here's one suggestion, for openers. While relief chiselers do exist, most of the poor sincerely want work. The trouble is, they have nothing to offer that anybody wants to pay for; and many, if not all, seem constitutionally unable to learn the skills that are in demand.

This is not, repeat *not* a racist remark. The poor include people of every race. If there is among them, statistically, a certain deficiency of intelligence, it may well have nothing to do with heredity. Current research seems to be demonstrating that undernourishment in the womb and in infancy causes brain damage.

So conceivably we should drop our efforts to turn the adult poor into instant middle class. It may be impossible. Conceivably the real way to help them is to find work they can do. We have a lot of demand, even nowadays, for servants of every kind; cleaning up the environment calls for a lot of manual labor; we could borrow a leaf from the Russians and bear down on the idea that this sort of job is dignified and socially useful.

Of course, that's a stopgap measure, to get us through the next couple of generations. The real effort should go, not into tearing down houses, but into providing adequate nutrition for every pregnant woman and small child. Rather than meddling in the private lives of people, our social workers should concentrate on educating them in how to eat properly, and making sure that they have the means to do so.

As said, frequently by now in the present essay, I don't know if this is a correct answer, nor do I believe anybody else knows. I only urge that we rethink the question.

They go on and on, these ideas taken so much for granted that they have seldom even been clearly formulated. I repeat that some may, actually, be more or less right; but we have no proof thus far. Others, hauled into the light of day, turn out to be unmistakably false, illogical, and generally rotten foundations for our decisions.

We will get nowhere unless we question, examine, wonder, play with alternatives. Here lay the greatness of John Campbell. ■

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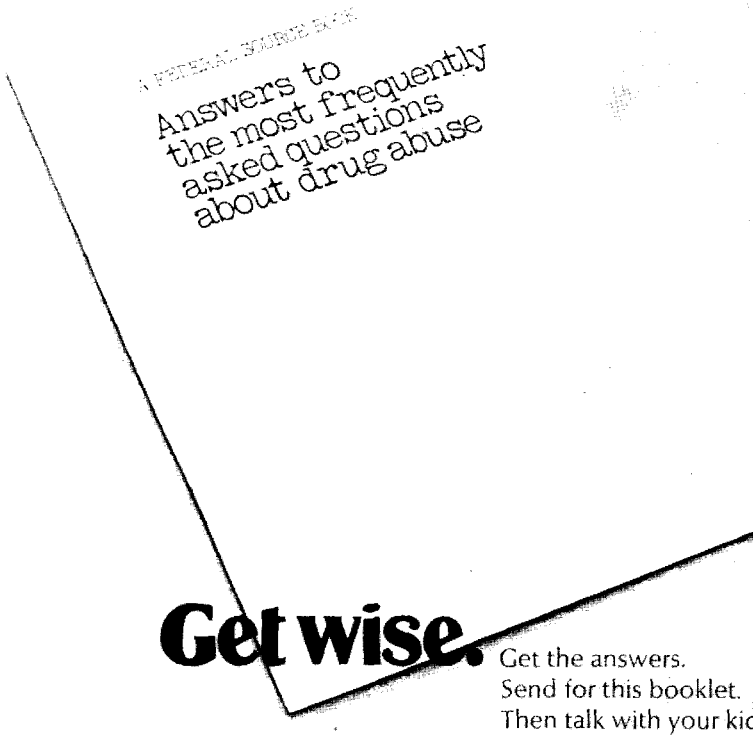

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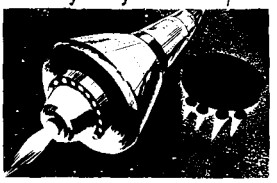

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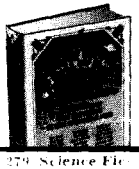

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